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**ENVIRONMENTAL ASSESSMENT PANEL  
REVIEWING THE  
NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT**

**COMPILATION OF SUBMISSIONS ON THE  
DRAFT GUIDELINES FOR AN  
ENVIRONMENTAL IMPACT STATEMENT**



**JUNE - SEPTEMBER, 1991**

**Federal Environmental Assessment Review Office  
Hull, Quebec**





(1)

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Hull, Quebec**





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Susan Toller  
FEARO  
13th floor, Fontaine Bldg.  
200 Sacre-Coeur Blvd.  
Hull, Quebec  
K1A 0H3

Dear Ms. Toller,

RE Nuclear Fuel... EIS Guidelines for Public Review

As a civil engineer, I have no special knowledge, either about nuclear waste or its impact on the environment. I have some knowledge of the transportation of dangerous goods and risk management, and currently am the director of the Institute for Risk Research. This letter is a personal letter. You should also be aware that the Institute receives sponsor funds from both A.E.C.L. and Ontario Hydro and my comments should be received with that as background.

I read the draft guidelines carefully and in general, I think that the information necessary to make a decision on the proposed concept is covered by the guidelines. The purpose of this letter is to express some concern about a few requirements in the EIS guidelines and also concern about what is not contained in the EIS guidelines, namely the position of the Environmental Assessment Panel on key issues such as how public opinion and the public interest will be assessed and how uncertainties will be resolved.

In my opinion, the Environmental Assessment process, has a proponent who wishes to dispose of nuclear waste, opponents who are opposed to nuclear power or who are concerned about impacts on the environment and the panel who represent the public and will convey to decision makers a recommendation "in the public interest". In addition there is the supporting scientific community who will offer advice on the technical and economic issues raised by the application.

I personally, not having studied the issues in any depth, do not have an opinion on the merits of the proposal, or for that matter the continued use in Canada of nuclear generated electrical power. However, it would appear from the literature that there are two schools of thought. On the one hand proponents indicate the very large benefits of this method of electric power generation and propose that through careful management the associated risks can be adequately controlled. They also maintain that the alternatives are not sufficient to maintain the demands for electrical power for our society and that there are also risks associated with other methods. On the other hand, opponents of nuclear power indicate that the risks are too high for society to accept and that there is a possibility of a catastrophic outcome that would severely damage Canadian society. They also maintain that there are alternative methods to meet the demands for electrical power, including conservation, that pose less risk.

The role of the panel is to reach a recommended position for Canadian society on the merits of the application. In my opinion, the application can not be divorced from the overall context of the use of nuclear power, and the associated benefits and risks. Moreover, I do not think that the selection of the site can be separated from the approval of the concept in principle. A cursory examination of the history of the OWMC should convince anyone of the futility of trying to do this. In my view the role of the Panel is to decide which of the two views outlined in the previous paragraph should be the policy of Canadian society. The Panel must also communicate their recommendations to the political decision makers in a convincing way. This is no small task and is difficult whichever outcome is recommended.

The OWMC has over the last decade spent well over \$100 million dollars in the pursuit of a similar answer to an easier question. The Panel is, I am sure, aware of the difficulties and the weight on their shoulders. My concerns with the EIS guidelines is that it appears that the Panel has set out on a course that will result in a repeat of the OWMC situation - much money will be spent and the issues will not be resolved.

With this as background let me indicate some specific concerns.

1. In section 3.31 the applicant is asked to define the "roles of key parties", and to inform on the "adequacy of public consultation". In my view this is clearly the role of the Panel and if this information were provided by the applicant then it would be suspect as being biased and of little value. In the same way section 2.3 ("perceived versus actual risk", "pathways..within our social system..understand..risk perceptions"), section 2.2 ("changing social perceptions", "Characteristics of public concerns", "ethical acceptability"), section 3.33 ("criteria..social acceptability") all ask the applicant to do the work of the Panel.

2. In section 3.521 the applicant is asked to include "the associated uncertainties", and "confidence limits". In section 3.541 "In view of the uncertainties...discuss the confidence in results produced". In section 3.62 "demonstration ..techniques have been developed, proven..". The Panel must be aware that whatever claims that are made by the applicant in respect of technical solutions and impact assessments there will be counter claims that the science use was incorrect, that the confidence limits are incorrect and that the results should be modified to reflect the views of other scientific facts and uncertainty. Again this is, in my view, the clear role of the Panel - to decide which science, that of the applicant or that of the opponents is to be used in formulating a recommendation.

3. In section 4.2 reference is made to "potential host communities/regions" and the request that certain information be provided for the same. This appears to be a way around dealing with specific sites and yet not dealing with specific sites. I would refer to my earlier view that the context of the application should be that of the continued use of nuclear power and the proposal of a specific site.



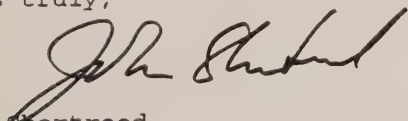
The central theme of these three points is that the Panel, in order to do its job, must address these issues. These are issues of the public interest and how it is to be determined. This is clearly the role of the Panel and not of the applicant. The adequacy of the involvement of the public, the resolution of uncertainties in our knowledge and informing on issues that will arise only when a specific site is proposed are the tasks of the Panel.

In my opinion, the EIS guidelines should be revised by the addition of a statement by the Panel on how it views uncertainty, how it will deal with public involvement, how it will balance public opinion and the public interest, how it will resolve differences in scientific "facts", etc. The process will never converge to a decision unless the Panel begins to take action to ensure that it will effectively represent society. To do so the Panel must early on in the process begin to set out its views on the critical issues in risk management. It can not sit back and hope that someone else will perform this role.

I am concerned that with the present guidelines the process will be long, very costly and have a high risk of failure, i.e. no decision will be reached.

If you would like further clarification or expansion of my views please let me know.

Yours truly,



John Shortreed  
Department of Civil Engineering  
University of Waterloo  
Waterloo, Ontario  
N2L 3G1

*June 17, 1991, Waterloo*











(4)

Susan Toller  
Federal Environmental  
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J. Quittner, P.Eng.  
595 St. Clair Ave. West  
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TORONTO, Ont. T6L 6T6  
M6C 1A3

June 17, 1991

JUN 20 1991

Ladies and Gentlemen:

RE: DRAFT GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL  
IMPACT STATEMENT (EIS) of June 1991

oo

THE NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT

oo

Introduction to FINAL guidelines might contain for the information of interested readers a short outline, with references for further reading, of the legal framework involved, such as Scoping, who must give permission to do what and at which stage, which opportunities for Public Input with time tables and outline of which levels of government are involved in the overall procedure.

2.1 Nature of Nuclear Fuel waste, 2nd para.:

- the nuclear fuel cycle with different kinds of cycles explained, the use of different materials and/or methods.

4.21 Demographics, 2nd para.:

- present populations and their structures in terms of nations, race.

5. Impact on the environment ; Add before 5.1: Estimated time tables should be provided

Add a new final item 8: Indicate which future areas of study would be useful, proper funding being available, and indicate to what extent which areas of the EIS would be affected by such studies. If possible attach estimated time tables.

Hoping the above will help,

Sincerely

J. Quittner









J. R. Baird  
1401 Rose Ann Drive  
Nanaimo, BC  
V9T 4L3  
(604) 758 4443  
June 19, 1991

Susan Toller  
Federal Environmental Assessment Review Office  
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Dear Ms. Toller:

The draft EIS Guidelines for AECL's Nuclear Fuel Waste Management and Disposal Concept calls into question the motive for the Federal Environmental Assessment Review process. Is this exercise intended as an apology for AECL's concept or is it meant to be an honest effort to ascertain the most appropriate method for handling and disposing of nuclear wastes in Canada? The public being the losers if the former is the case.

The reason the process is suspect is AECL's concept of irretrievably burying spent fuel rods runs contrary to the recommendations of both the 1988 Toronto conference, "The Changing Atmosphere: Implications for Global Security," and the 14th World Energy Conference in Montreal in 1989. The EIS however, makes no demands on AECL to reconcile this disregard for these recommendations. Recommendations it would be odd, at a minimum, for the host nation of both conferences to ignore.


Both conferences called for the reduction of CO2 emissions in the atmosphere. The Julich CO2 reduction scenario calls for the accomplishment of this by a shift from coal to natural gas and a greater dependence on solar power and biomass combustion. Nuclear power providing the remainder of the energy. The extent to which the nuclear power industry would have to be revived to meet the recommended CO2 reduction goals however, would create a demand for uranium which would deplete known reserves within twenty years. Subsequently spent fuel would have to be reprocessed to reclaim the 94 percent uranium remaining in the spent rods to meet the proposed fuel demand. The AECL concept of irretrievably burying spent fuel rods therefore, is a contradiction of these recommendations.

The AECL concept also overlooks the export reactor and fuel rod sales potential afforded by a waste disposal concept capable of accommodating imported wastes. A process with the capability of temporarily storing these wastes, ultimately for reprocessing, and of accommodating the wastes from the reprocessing process. A concept which would afford an operative means of controlling the proliferation of weapons grade material, the principal impediment to the expansion of the nuclear power industry to date.

The AECL concept also overlooks the environmental hazards Canadians are at risk to due to the handling of nuclear wastes in other countries. Wastes such as those stored at Hanford, Washington. In tanks the U.S. Energy Department has been forced to acknowledge have explosive potential. Wastes which could be disposed of by a process such as the Subductive Waste Disposal Process which W.D. Smythe, Director General, Atomic Energy Control Board, has acknowledged "would obviously have some unique advantages over other techniques currently in use if it can be shown to be viable, and would be of great interest to people with responsibilities in the general area of waste management," and in the process of disposing of these wastes the risk to Canadians as well as Americans in the north western states would be negated.

I respectfully suggest these matter require addressing if the panels work is to have validity.

Sincerely,



J. R. Baird









OTTAWA-CARLETON HEALTH DEPARTMENT  
SERVICE DE SANTÉ D'OTTAWA-CARLETON

Medical Officer of Health • Le médecin hygiéniste  
Dr. S. J. Corber, M.D., D.P.H., F.R.C.P.(C)

June 26, 1991

Ms. Susan Toller  
Federal Environmental Assessment  
Review Office  
13th floor, Fontaine Building  
200 Sacré-Coeur Boulevard  
Hull, Québec  
K1A 0H3

**Re: Nuclear Fuel Waste Management Guidelines**

Dear Ms. Toller:

The Ottawa-Carleton Health Department has reviewed the attached document. In our view, the guidelines for preparation of the EIS are very complete. Once completed, the EIS should provide an excellent background document on the problems and issues involved with nuclear waste management.

Sincerely,

A handwritten signature in dark ink, appearing to read "S. J. Corber".

S. J. Corber, M.D., D.P.H., F.R.C.P.(C)  
Medical Officer of Health











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Deep River, Ontario  
K0J 1P0  
(613)584-2765  
1991 July 12

Mr. Blair Seaborn, Chairman  
Nuclear Fuel Waste Management Panel  
Federal Environmental Assessment Review Office  
13th Floor Fontaine Building  
200 Sacre-Coeur Blvd.  
HULL, Quebec  
K1A 0H3

Dear Mr. Seaborn,

Most of this submission to your Panel represents my response to its invitation to comment on the draft "Guidelines for the Preparation of an Environmental Impact Statement" dated June 1991. First, however, I wish to address some subjects relevant to the Panel but not covered in the subject document.

Susan Toller of the Panel's secretariat has stated (interview on CBC-Radio Ottawa, 1991 July 4, 12:30 am) that hearings are now not expected until 1994. This, if achieved, will be six years after the concept was referred to the Minister of the Environment, and the Panel's Report cannot be expected for several more years. I submit that this is indefensible and a cause of shame for the Government of Canada, especially when it is generally agreed that disposal of nuclear wastes is a serious public concern. For comparison, World War II took less time, building a power reactor can take less time, and the media have reacted negatively to the expectation that the Department of the Environment's Panel for the Great Whale project will take as long as two years.

I realize that the Panel is not responsible for all the delays and may have little influence on ministerial inaction. However, it should realize that from outside Ottawa it is all viewed as one amorphous, unresponsive bureaucracy. Also the recent Citizen's Forum, whatever its faults, has demonstrated how a panel can muster the resources and the will to complete its mandate within a reasonable period. I have made this point forcibly because I believe it could affect the Panel's activities in at least two respects.

First, the Panel should be doing everything possible to avoid future delays. As an obvious example, it should review its schedule, to advance the start of the hearings: It is not clear why AECL should require a year to prepare the EIS for a concept which it has been studying for more than a decade. Second, the Panel should be occupying the period up to the hearings with activities for which it, not the proponent, has the responsibility: Apart from the guidelines for the proponent's

EIS, I have seen no plan or schedule for the Panel's activities.

The need for such parallel activities can be inferred from the Panel's terms of reference. The Panel was directed to review "a broad range of nuclear fuel waste management issues", distinct from a review of AECL's concept. It was further directed to advise "on the steps that must be taken to ensure the safe long-term management of nuclear fuel wastes in Canada". The terms stated that the SRG would "provide advice on other issues to the Panel when requested"; that the Panel would consider "various approaches to the long-term management of nuclear fuel wastes"; that the Panel will examine "the impact of recycling or other processes on the volume of wastes"; that the Panel will consider "the degree to which we should relieve future generations of the burden of looking after the wastes"; and "the Panel may review the methodology required to characterize sites and the potential availability of sites in Canada ... and advise governments on a future site selection process".

It is my contention, that while AECL may legitimately have views on these issues, the primary responsibility for resolving them is the Panel's. Furthermore, these issues are largely independent of the EIS, as envisaged in the draft guidelines, and so need not await preparation of the EIS. How does the Panel intend addressing these issues? If it simply intends postponing any consideration of them until after the hearings on the EIS, it should state this explicitly: If not, it should publish its plan for public comment, as it expects of others.

As a constructive suggestion, I urge the Panel to use the period of EIS preparation to tackle these issues. It might follow the Atomic Energy Control Board's pattern of issuing a consultative document on each issue, inviting public comment; or it might convene a symposium, or a series of symposia, first.

Although it is not mentioned explicitly in either the terms of reference or the guidelines, I would urge that the ethics of nuclear-wastes management be included in these issues. As I mentioned during our brief conversation at the Royal Society of Canada's meeting at Queen's University last month, my review of submissions to the Scoping Hearings revealed that this was a recurring issue. While the overwhelming assumption of these submissions was that an ethical review would favour the anti-nuclear position, I hold the diametrically opposed view. Should the Panel decide to examine this question, I would welcome an opportunity to present my case to the Panel.

The rest of this submission consists of comments on the draft guidelines, in order of their appearance without regard to their relative importance:

Page/Sect.

p1 The Introduction should make it clear that mine/mill tailings are excluded from the Panel's scope, even though these could legitimately be considered "Nuclear Fuel Waste". It is my



understanding that it was the Minister of Energy, Mines and Resources, not AECL, that submitted the concept to the Minister of the Environment in 1988 September (see Panel's "Operational Procedures"): I do not know how much earlier AECL submitted the concept to its Minister.

- 2.1 Something appears to have been omitted from the end of this section, judging by the fact that it ends "... and"
- 2.2 The requirement for documentation of past performance should be restricted to "the Canadian nuclear industry". The proponent is not responsible for other national programs, particularly for nuclear weapons programs; the Panel has issued its own review of national programs; and much of the international experience is irrelevant to the present concept, so that documentation would not be cost-effective. If the Panel is really seeking documentation on international performance, it should restrict the requirement to "relevant past performance".
- 2.3 The Panel should not be asking for identification of "worst case scenarios" since there are no such things. This is the sort of rhetorical trick beloved by the media that live off "disaster-of-the-week", but unworthy of an official inquiry. There is no end to the "what-if" game. Whatever is postulated as the "worst case", it is always possible to postulate something worse by making some further unjustified assumption. The Panel should either consider the probabilities of various consequences or specify and justify the improbable scenarios that it requires the proponent to examine.
- 3 Here, and throughout the Guidelines, "accomodate" (sic) is misspelled.
- 3.32 It is an artificial dichotomy to require consideration of only the extremes irretrievable burial and retrievable storage. My comments, dated 1990 October 29, on the AECB's submission to the Scoping Hearings addressed this point.
- 3.512 Here, and elsewhere in the Guidelines, there is a requirement for comparison to (sic) and contrast with alternative "concepts developed by waste management programs in other countries, and significant differences should be explained and justified". Such a requirement is very easily stated, but involves much skilled effort if it is to be satisfied literally. The Panel should be responsible in its demands. For instance, the requirement could be restricted to "concepts proposed by the national authorities in other countries".
- 3.513 There should be a requirement for quality assurance and control procedures for all appropriate stages, e.g., the sealing materials, and not just selected stages.
- 3.541 It does not seem logical to talk of the "predicted life of

(a) repository" if, in implementing irretrievable disposal, the repository is intended to be abandoned. Furthermore, what appears in the passage on "Verification and validation" should surely apply to the whole "Multiple Barrier System" (Section 3.54) and not just the repository narrowly. Under "Uncertainties", how is it possible to discuss an amount that is unquantifiable?

3.546 To avoid undesirable prescription, "i.e." should read "e.g.".

3.6 A very serious and unjustified prejudice seems to be introduced here through the wording. In requiring definition of an "ideal" site and a "ranking" process, presumably in order of preference, the Panel seems to be assuming a need for the best. This is reinforced by references to a "hierarchy for acceptance or rejection" in Sections 3.61 and 3.62. The Panel's terms of reference require it to review the safety and acceptability of the concept and, I submit, the subsequent objective should be to select an acceptable, not an ideal, site. The paragraph on site selection in the Panel's terms of reference is more carefully worded than are these sections. I have addressed this question of "Le mieux est l'ennemi du bien" in my letter to you of 1990 December 5.

3.71 There has been no decision on which entity or entities will be responsible for implementing any concept that may be approved. Eventually, this decision will be the responsibility of governments and/or the fuel's owners, not of the concept proponent. It is therefore improper for the Panel to require the proponent to "describe" the project management and operation. The wording could be revised to request the proponent to identify possible options with a discussion of the pros and cons of each. However, here and elsewhere, the Panel should be very clear if and how the information required will affect its decision on whether the concept is acceptable. To demand information with no clear purpose is bureaucracy run amok. The final item in this section assumes, unjustifiably, that it is desirable to make future generations aware of the location: This question should be open to debate.

3.73 The requirements of this section are unrealistic for an unknown site at some unknown time in the future. Unless the Panel can foresee some way that labour requirements could render the concept unacceptable, this information is appropriate to a siting EIS. The same comment applies to "3.74 Emergency Planning".

3.81 The comments on Sections 3.71 and 3.73 apply here too.

3.82 In describing the performance of the container system the proponent should also discuss the probable consequences of representative accident scenarios. In my opinion, these consequences are grossly exaggerated in the public's perception.



3.83 There is an unjustified assumption that the public should be informed on transport routes, etc.. As long as there are terrorists and mischief-making special-interest groups willing to disrupt society's legal activities, the alternative should be left open for nuclear and all other shipments. This raises the question of security requirements. The proponent should consider whether there should be a limit on the amount of fissile material per shipment and whether the vehicle should be capable of immobilization in the event of an attack. Before calling for such information, however, the Panel has to state how it will be managed to preserve security. Advice could be obtained from the Ontario Royal Commission on Electric Power Planning that had the same problem.

3.9 "... indicating optional sources of funding."

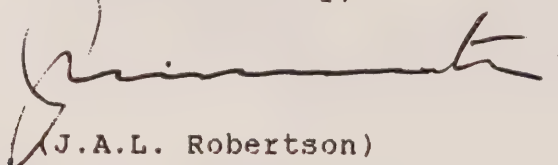
4 This whole section is both illogical and dangerous. The introductory sentence is reasonable in requiring an explanation of the approach. However, in what follows there is repeated reference to "potential host communities/regions". It is illogical in expecting the proponent to describe characteristics of unknown sites. If the range of the variables needed for the concept assessment has been selected judiciously, as endorsed by the SRG, it should be possible to find a suitable site. It is dangerous in that it could destroy the whole fragile foundation on which the acceptance process has been built. By separating concept acceptance from site selection those responsible offered the possibility of dealing with the former without the automatic opposition resulting from the NIMBY reflex. If any actual communities identify with "potential host communities" in the EIS we can expect the sort of opposition that has thwarted all efforts to clean up low-level radioactive wastes in the Port Hope region for decades. If this were to result in the present process being aborted after six years devoted to it, the Panel would bear a heavy responsibility. I again urge the Panel to consider whether this information is needed for it to discharge its mandate. Inclusion of this, and other material in Section 3, seems to me to represent an unthinking carryover from requirements for a usual EIS where a site is being proposed. If, however, the Panel really foresees a need for this information, I suggest that the Panel should identify two or three hypothetical scenarios that should be considered: One might be a site 25 km from an existing town of 5000 on a highway while another might be a site 100 km from the nearest established community. Similar comments apply to Section 5.

6 The proponent should be required to discuss not only the risks but also the costs and benefits of the alternatives. The Panel should constantly bear in mind that resources devoted to diminish a particularly risk to anomalously low levels will not be available to tackle greater risks elsewhere. "How safe is safe enough?" is a question that is

often posed: "How safe is too safe?" should also be posed. Retrievability is not a simple yes/no question; the timing has to be considered (see my communication to the Panel dated 1990 October 29).

- 7 The Siting Task Force for Low-Level Radioactive Waste Management has distinguished between impact-related and equity-related compensation. This is a very important and valuable principle that the Panel should incorporate.

Yours sincerely,



(J.A.L. Robertson)

cc. C.J. Allen, AECL Vice-President Waste Management  
AECB's Advisory Committee on Nuclear Safety





JUL 18 1991

Your file    Votre référence

Our file    Notre référence

Ms. Susan Toller  
Federal Environmental Assessment  
and Review Office  
Fontaine Building  
200 Sacré-Coeur Blvd., 13th Floor  
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K1A 0H3

Dear Ms. Toller

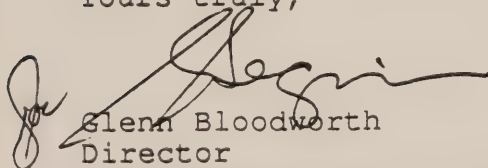
Thank you for the opportunity to comment on the Guidelines for the Preparation of an Environmental Impact Statement for the Panel reviewing the Nuclear Fuel Waste Management and Disposal Concept.

My main concern with the document is that it is not always clear that local labour includes aboriginal peoples (e.g. Section 3.73 and Section 3.84). To avoid any ambiguity, I therefore suggest that the noted sections be amended to make specific reference to the employment of aboriginal people.

Although the guidelines deal with a concept rather than a proposal and thus do not follow the normal format which requires the description of impacts and mitigation; I presume that the proponent will describe the mitigative measures in its concept. If an exclusion or safety zone is an element of the mitigative measures to protect the aboriginal peoples or their country's food source, this measure in itself should be fully described and its overall impacts assessed.

I trust that my comments have been of assistance to the Panel in finalizing the guidelines.

Yours truly,



Glenn Bloodworth  
Director  
Environment Directorate

Canada











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July 25th, 1991

Ms. Susan Toller  
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Dear Ms. Toller:

Thank you for sending me a copy of the draft guidelines (June 1991) for the preparation of an environmental impact statement re the Canadian nuclear fuel waste management and disposal concept. I have reviewed the report and found it to be well organized, comprehensive and essentially complete. Congratulations to the Nuclear Fuel Waste Management Environmental Assessment Panel for a difficult job well done!

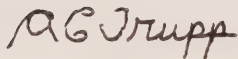
While reading the report, I especially watched for several items upon which I would like to comment briefly:

- (1) Chapter 2: Nuclear Fuel Waste - The Problem: The predominate high-level hazardous waste is, of course, spent nuclear fuel bundles. But Canada's nuclear reactors are fast aging (and several have already been shut-down), and there are radioactive wastes associated with decommissioning or overhaul/modification. These will be low and intermediate-level wastes, but they will tend to involve high volumes. I believe this problem should be addressed at the present time so that together with spent fuel management, we will work towards permanent, steady-state solutions to the unresolved problems associated with nuclear fission energy.
- (2) The solutions mentioned above, must be both scientifically and economically acceptable. Concerning the latter, Section 5.24 should specifically ask for the impact of disposal costs on the true unit cost of non-subsidized nuclear-generated electricity. This is an important bench-mark number vis-a-vis alternative energy sources.
- (3) I was pleased that the question of retrievable storage versus irretrievable burial is raised in several places. AECL will argue for the latter. Resolution of this point is pivotal in reaching a decision. I suspect that the majority of Canadians will accept retrievable storage with perpetual surveillance. In fact, I suspect that many Canadians consider irretrievable burial as a colossal mistake.

- (4) For irretrievable burial, closure is a crucial aspect. As pointed out by others, no matter what is done to close-off the ventilation and main shafts, nothing can approach the extremely low permeability of granite, especially at the original borehold-backfill interfaces. In other words, plugged shafts will be the short-circuits to the biosphere once primary containment is breached. Perhaps Section 3.513 should specifically request this point to be addressed.
- (5) Section 3.541: The very important question of validation (of performance modelling) is raised, and I look forward to the forthcoming technical detail provided by AECL.
- (6) I was pleased to see that transportation of nuclear fuel wastes is included (as, of course, it should be). Section 3.8 seems to cover all bases including design criteria for shipping flasks and risk analyses.

Once again, thank you for the report. I hope the above comments are useful to the Panel.

Yours truly



Dr. A.C. Trupp, P.Eng.  
Professor

ACT/knv









F.O.C.A.

(17)

# The Federation of Ontario Cottagers' Associations Incorporated

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July 31, 1991

Susan Toller  
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K1A 0H3

Dear Susan Toller:

Please find enclosed our Submission to the Draft EIS Guidelines. We will use your number system to identify the location of our comments in your document.

2.0 & 2.1 We refer to our Submission to the Scoping meeting (Toronto, October 22, 1990, 7 p.m.) where we raised the issue of the anticipated magnitude of Nuclear fuel waste, which depends to a significant degree on the decision of the Government of Ontario regarding the future of nuclear energy plants.

It is our opinion that no final decision for the long-term management of nuclear fuel wastes should be made until the Government of Ontario has reached a decision on the future of nuclear energy plants.

2.3 We believe that AECL should consider the possibility of terrorist intervention for the short-term (above ground) management of nuclear fuel wastes and provide a cost estimate for adequate protection.

3.512 It is our understanding the AECL is at present favouring titanium containers while Sweden has opted for copper containers. We urge that AECL be required specifically to compare the advantages and disadvantages of each, including their respective costs.

.../

Susan Toller

July 31, 1991

- 3.521      The potential creation of widening of fracture zones due to stress changes or possible earthquakes should be addressed in great detail by AECL.

The position, stated to us during our visit to the Whiteshell Nuclear Research Establishment in Pinawa, that earthquakes have little or no impact below ground, needs to be documented more fully using the experience of other jurisdictions where applicable.

- 3.6      AECL should be asked to state the approximate size (in square meters) of the required area or site for the long-term management of nuclear fuel wastes should the AECL Concept be accepted. AECL should also be asked to comment on the proposed use of this area. Does the AECL recommend a permanent and total restriction of access to this area? If not, what is their recommendation and their reasons for their recommendation.

3.71 - 3.74  
& 3.84 - 3.85

Finally, we want to raise our concern regarding an important aspect of the construction, operation and decommissioning of the concept facility, and the management related aspects of these activities.

To a lesser extent, our concern includes the management of transportation of nuclear fuel wastes.

Since our submission on this particular issue may well be outside the expertise of Panel members, as well as those of AECL, please allow us to provide you with a very brief summary of relevant background information.

The organization of work in western industrialized societies has been dominated by the ideas of Scientific Management (F.E. Taylor, 1911) and the model of an ideal bureaucracy developed by Max Weber (1947). Management control in such a system (the traditional paradigm of the organization of work) is achieved through layers of supervision, bureaucratic procedures, and rigid lines of demarcation between manual and mental work.



Susan Toller

July 31, 1991

During the last two decades, this old paradigm of work has come under increased criticism. It is now, admittedly only gradually, being replaced by a new paradigm based on a new relationship between the two parts of any organization (of work) : the technical subsystem and the social subsystem. Both are required to transform input into output. In the Old Paradigm, the technical subsystem was dominant; the New Paradigm views both as equally important and seeks to find an acceptable coupling of the two subsystems.

Allow me to cite a recent and relevant example to relate this brief and simplified introduction to the issue of nuclear power generation and management of nuclear waste.

In the near disaster of the Three Mile Island case, testimony presented to the commission of inquiry indicated that the organization of work in the plant followed the Old Paradigm of work. It was based on the assumption that reliability, safety and efficiency could be achieved only by the creation of a "fool-proof" technical system. The social system (the way work was designed, organized, and supervised) consisted of a "traditional" (old paradigm) steep hierarchy and rigid division of mental and manual labour. Operations were restricted to manual work (e.g. moving levers) and engineers, who monopolized all mental work, were not permitted to adjust meters or turn knobs, jobs classified as manual work. Furthermore, no operator or engineer knew how to operate more than a small part of the plant. It should come as no surprise that a near disaster occurred.

We recommend that AECL be requested to give serious consideration to the way work will be organized in the management of the project as well as the management of the transportation system. If their expertise does not include the details of the organization of work, AECL should consult with experts in this area.

#### Sources:

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New Forms of Work Organization: The Challenge for North American Unions.  
University of Toronto Press (Chapter 1)



Susan Toller

July 31, 1991

Davis, L. (1983)

"Workers and Technology: The Necessary Joint Basis for Organizational Effectiveness", National Productivity Review, Winter, 7-14.

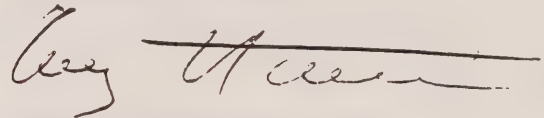
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"The Soul of a New Worker", Working Paper Magazine, 9 (1, Jan. - Feb.)

Sincerely yours



GERRY HUNNIUS, Chair  
FOCA Committee on  
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Disposal

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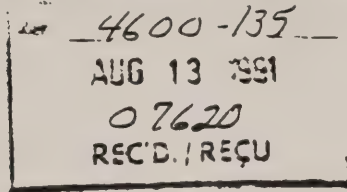






# SASKATCHEWAN ENVIRONMENTAL SOCIETY

(21)



8 August 1991

Susan Toller  
Federal Environmental Assessment Review Office  
13th floor, Fontaine Bldg.  
200 Sacre-Coeur Blvd.  
Hull, Quebec  
K1A 0H3

Comment re "Guidelines for the Preparation of an Environmental  
Impact Statement, the Nuclear Fuel Waste Management and Disposal  
System, June 1991"

Dear FEARO,

There are three issues which seem to me to be missing from the draft guidelines for the EIA on the Nuclear Fuel Waste Management and Disposal Concept.

There is no reference to limitations on the sources of waste to be stored. For example, the issue of waste disposal changes if one is considering the option of accepting wastes from other countries than Canada. This is a possibility which is being discussed by some proponents of the nuclear industry, and it needs to be addressed in the EIA.

Secondly, the issue of preventing diversion of plutonium-containing wastes for weapons use needs to be discussed.

And thirdly, we need to talk about what happens to regulatory and safety systems in the event of civil war or of the break-up of Canada.

Please consider amending the guidelines to take these issues into account. Thank you.

Yours truly,

Ann Coxworth  
Program Coordinator









ENVIRONMENTAL ASSESSMENT OF NUCLEAR  
FUEL WASTE MANAGEMENT

COMMENTS ON THE DRAFT  
GUIDELINES FOR THE E.I.S.

Environment North  
Box 2505  
Thunder Bay, Ontario  
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August, 1991

Generally, Environment North believes that the draft guidelines are reasonably thorough; however, we still have a major concern about the legitimacy of this whole exercise.

One of the issues which was raised repeatedly during our community consultations was the continuing production of nuclear waste. Many people felt that Canada should be concentrating on reducing or stopping the flow of spent fuel, before worrying about where to put the waste already here.

The terms of reference given to this Panel preclude any discussion of nuclear energy, demand management and overall energy policy. This will result in a focussed debate, but a debate so circumscribed as to leave out half of the waste management equation. Common sense suggests that waste production and disposal must be considered together.

The government is aware of this problem. The Environment Minister himself acknowledged the dissatisfaction with the terms of reference when he announced the formation of this Panel on October 4, 1989. At that time, Mr. Bouchard stated that he would "be considering the most effective way of launching" a public discussion of energy policy and nuclear energy. An inquiry was, indeed, proposed by the government - however, the suggested terms of reference, excluding consideration of energy conservation and efficiency, were so narrow that they were almost universally rejected by the environmental community. The proposal was subsequently withdrawn, leaving the EA into Nuclear Fuel Waste in the same position as before - with half a mandate, and limited public legitimacy.

We are aware that the Panel has made representations to the government before concerning this matter. We ask that they try again. The issue is an important one.

Apart from this overriding concern, we do have some suggestions for improving the EIS Guidelines. These are outlined below. In each case, we have indicated the Section which we would like to see amended, and the reasons for the proposed change.

#### **Section 2.2, second paragraph**

"Past performance of nuclear *industries, in Canada and in other nations*, in managing nuclear fuel waste should be documented."

The past performance of the nuclear industries in other nations in managing nuclear fuel waste is very pertinent to this assessment. The request for this international data should be made specific.

### Section 3.2

Add at the end of this section: ***"The proponent should state whether this concept is restricted to the management of Canada's nuclear fuel waste, or if it extends to the management, in Canada, of nuclear fuel wastes from other nations. In the latter case, the implications of importing nuclear fuel waste on site selection criteria, transportation systems, the design of engineered barrier systems, and on human and natural environments should be considered in the discussions of these topics."***

The idea of importing nuclear fuel wastes from other nations for management in Canada has been raised before by AECL, and, to our knowledge, has never been disavowed. Nothing we have read about the current proposal rules out such imports; indeed, all references are to "the management of nuclear fuel wastes in Canada", not to "the management of Canada's nuclear fuel wastes". Since AECL itself has raised the idea of importation, this wording cannot be dismissed as simply a matter of semantics.

The importation of wastes would have major implications in many areas. The proponent should clearly state if the importation of nuclear fuel wastes is a part of the current proposal, and is to be considered in this assessment.

### Section 3.9, first paragraph

***"The cost of research, monitoring, possible mitigation and compensation should be included."***

Research costs associated with the development of the disposal concept already total some hundreds of millions of dollars. The amounts and sources of funding for this research are very relevant to this assessment.

### Section 5.23

***"- health impacts from radiation exposure to future generations in area surrounding facility, and in more distant areas,"***

Health impacts to future generations will not necessarily be restricted to the area surrounding the facility. Ground water, surface water, and biological transport of materials could well produce impacts in more distant areas.



### Section 7.

Delete: “– identification of community decision-making structures and processes for the incorporation of these decision-making structures into site selection decisions;”

Add: “– *the definition of a host community, for purposes of compensation, public consultation, and decision-making;*

– *identification of community decision-making structures and processes;*

– *identification of the stages in the site selection process when the community decision-making structures would be utilized, and the manner in which these would be used;*

– *the method of providing public access to information during the selection process, particularly information from sources other than AECL, AECLB, and EMR;*

– *the provision of funding for local public-interest groups to participate in the site selection process;*

– *the choice of an agency to carry out the site selection process;*

– *the assessment and regulatory mechanisms to be satisfied during the site selection process;”*

Back in the early 1980's, Atikokan was the location of an AECL research program. Much of the conflict in Atikokan was due to uncertainty about the company's intentions. Was AECL really there only to drill a few holes in the ground and then leave, or was this the start of something much bigger? This uncertainty was made worse by the continually changing public pronouncements on the rights of the community to reject the drilling, and / or a repository. Both federal and provincial governments vacillated on this issue, and the constantly changing ground rules made many residents feel that they were being manipulated and victimized.

The recent experience with siting a low-level repository has been somewhat happier, mainly because some lessons have been learned from what happened in Atikokan. The documents distributed to the potential host communities are now precise and detailed in describing how the process will work. People can see what they are getting into, and much of the uncertainty is thus removed; however, even in the low-level process we have heard complaints about access to information, particularly information from sources other than AECL, EMR, and AECLB.

In the Draft Guidelines, Section 7. is now so vague as to what is required, and so brief, as to encourage a sketchy and loosely-worded site selection proposal from AECL. We want AECL's proposal for a site selection process to be detailed and precise. A proposal which does not meet this standard will be viewed as being open to abuse and manipulation.







Atomic Energy Commission de contrôle  
Control Board de l'énergie atomique

Ottawa, Canada  
K1P 5S9

(27)

Directorate of Fuel Cycle  
and Materials Regulation

Telephone: (613) 995-4055

*Your file* *Votre référence*

*Our file* *Notre référence*

August 26, 1991

10-83-0

Ms. Susan Toller  
Federal Environmental Assessment Review Office  
13th Floor, Fontaine Bldg.  
200 Sacre-Coeur Blvd.  
Hull, Quebec  
K1A 0H3

Dear Ms. Toller:

In June 1991, the Federal Environmental Assessment Review Office published a document entitled "Guidelines for the Preparation of an Environmental Impact Statement" concerning the nuclear fuel waste management panel. Together with that document, the office invited comments.

I am enclosing the Atomic Energy Control Board's comments on the proposed EIS Guidelines, these comments having been approved by the Board at its meeting on the 22 August 1991.

If the panel wishes clarification of any of these comments, please let me know.

Yours sincerely,

G.C. Jack  
Manager  
Wastes and Impacts Division

Encl.

/sf

Canada

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Your file    Votre référence

Our file    Notre référence

1991-08-01

37-16-2-0

MEMORANDUM

NOTE

TO : Members  
Atomic Energy Control  
Board

FROM : Directorate of Fuel Cycle  
and Materials Regulation

PURPOSE: Decision

SUBJECT: Guidelines for EIS on  
AECL's Concept for Nuclear  
Fuel Waste Management

AUX : commissaires,  
Commission de contrôle  
de l'énergie atomique

DE : la Direction de la  
réglementation du cycle  
du combustible et des  
matières nucléaires

BUT : Décision

OBJET : Lignes directrices pour  
l'énoncé d'impact  
environnemental concernant  
le concept d'EACL  
d'évacuation des déchets de  
combustibles nucléaires

SUMMARY

The process of public review of the concept for nuclear fuel waste disposal is being conducted under the EARP process. During the fall of 1990, the Panel conducted public scoping meetings to receive issues from the public and other interested parties. The panel is preparing guidelines to AECL for the preparation of the Environmental Impact Statement. The review process further requires that the draft guidelines be subjected to a period of public review prior to being finalized and given to AECL.

SOMMAIRE

L'examen public du concept d'évacuation des déchets de combustibles nucléaires est actuellement effectué dans le cadre du processus d'évaluation et d'examen en matière d'environnement. Durant l'automne 1990, la commission chargée de cet examen public a tenu des réunions publiques préliminaires afin de recevoir les questions du public et d'autres intéressés. Cette commission établit à l'intention d'EACL des lignes directrices pour la préparation de l'énoncé d'impact environnemental. Le processus d'examen exige aussi que le projet de lignes directrices soit assujéti à une période d'examen public avant d'être terminé et remis à l'EACL.



The draft guidelines were issued June 13, 1991 and comments will be received by FEARO until September 16, 1991. Staff have reviewed the draft and submit the attached document for the approval of the Board. It is proposed that this document be submitted to the Panel as the AECB response to the draft guidelines.

Le projet de lignes directrices a été publié le 13 juin 1991 et le Bureau fédéral d'évaluation et d'examen environnemental recevra les commentaires jusqu'au 16 septembre 1991. Les agents de la CCEA ont examiné le projet et soumettent le document ci-joint à l'approbation de la Commission. Il est proposé que ce document soit présenté à la commission chargée de l'examen public en tant que réponse de la CCEA au projet de lignes directrices.

*JH Beare*

AECB Response to Draft Guidelines for an EIS on  
AECL's Concept for Nuclear Fuel Waste Management and Disposal

The Federal Environmental Assessment and Review Office (FEARO) has issued draft guidelines (see attached) for the preparation of an environmental impact statement (EIS) concerning the nuclear fuel waste management and disposal concept. Comments on these draft guidelines will be received by FEARO until September 16, 1991. The AECB believes there are several aspects of the guidelines which need to be modified. These proposed modifications are divided into general matters and specific technical items.

Part I - General Comments

**Outcome of the Panel's Review**

The sixth paragraph in the Introduction to the draft guidelines document mentions that the two Ministers will decide whether the project will proceed, and if so, under what conditions. Since only a concept is being reviewed by the Panel, there is no project, as such, which would proceed. It could well happen that any actual project might be proposed by some party other than an agent of the federal government. Therefore, it seems to the AECB that the decision to be reached by Ministers is whether the concept as proposed by AECL is, or is not, viable; or acceptable; or whether further work is required to arrive at a decision. The guidelines should be modified to state the correct decision that Ministers will have to make.

**Proponent's Responsibilities**

The terms of reference for the Panel include general matters of policy and regulatory criteria. The guidelines request that the proponent comment on these areas in addition to those of a more technical nature. We agree with this. We are concerned, however, that some of the specific wording used in the guidelines could be misinterpreted. We would recommend that the text of the guidelines be critically examined to ensure that inputs other than from the proponent will be available and that it is the Panel itself which will play the central role in making judgements on the acceptability and viability of the concept.

Since no decision is required on who would locate a site, construct and operate a disposal facility it should be made clear that AECL is being asked only to outline *possible* approaches to project management, rather than *proposed* approaches. In addition, some of the issues in Section 7 depend on future policy decisions by governments. It is inappropriate to ask AECL to make proposals regarding who would administer the siting process and regarding the use of compensation in such a process, although AECL could be asked to discuss these issues.

**Performance Assessment**

A wide variety of specific technical issues have been raised in the draft guidelines. It is important, however, that the EIS not only addresses them individually, but also puts them into an appropriate context. We recommend

that the guidelines reflect a stronger focus on ranking the various phenomena and processes which may affect a future repository in terms of their overall risk to human health and safety and to the environment. AECL should be requested to justify these rankings as well as any other choices or decisions it makes in the EIS. This latter requirement is not always clear from reading the current draft guidelines.

A further general concern is the apparent implicit acceptance of some of the basic approaches AECL has developed. These approaches should themselves be critically evaluated by the Panel. This implicit acceptance is reflected in subtle ways such as requests for data to be presented in distributed form which implies acceptance of the use of probabilistic models like SYVAC. We believe it is premature to either accept or reject any particular approach. It is part of the function of the EIS to propose and justify various approaches, various models, various data collection methods, various natural analogues and other supporting information. As outlined in the AECB presentation at the scoping hearings, various approaches should be used given the large anticipated uncertainties in any one approach. This uncertainty is composed of several parts (data, scenarios and models). Some assessment tools are clearly better suited to address some of these parts than others and the use of various approaches is necessary as a cross-check to give confidence in the predictions. It should be made clear to AECL that this variety of approaches is essential to a proper review of the concept. The AECB will be devoting considerable effort on this issue both during the concept phase and ultimately during the licensing of any facility.

We also note that the guidelines give very general guidance in some areas and are very specific in others. It is not clear what the basis is for these differences in the level of detail being requested. If the panel has already determined that some processes are more important than others, we would suggest the reasons be given. An example is channelized flow which is singled out for particular attention while the more basic hydraulic properties of conductivity and gradient are not mentioned. The structure of the guidelines compounds this concern as issues are repeated in the engineered barriers, vault and geosphere sections, but without consistent terminology or level of detail. We recommend that the level of detail required from AECL be made consistent and that the basis for that consistency be the importance of system components or processes to the overall performance of the repository. We also recommend a glossary be provided to ensure consistent use of such terms as: "long term", "short term", "retrievable" and "irretrievable" burial, "retrievable storage", "disposal" and "storage". The use of these terms in the guidelines needs to be critically reviewed as it appears the Panel is using some of them in a way that is different from common usage in the waste management field.

#### Retrievability and Post-closure Monitoring

The guidelines refer extensively to the deep geological disposal concept as "irretrievable burial". Section 6 even asks for a study of alternatives to "irretrievable burial". This, in our view, reflects a fundamental misunderstanding of the term "disposal" and will only serve to reinforce a popular misconception. The term "disposal" should not be taken to imply



"irretrievable" any more than the disposal of municipal wastes into landfill sites is irretrievable. The main difference between the two situations is in the difficulty and cost of retrieval. The phrase "deep disposal into a geological formation" refers to a concept of placing nuclear fuel wastes into a geological formation in such a manner that there is no intent, nor should there ever be a need, to retrieve the wastes in order to protect this and future generations. This does not mean that it would be impossible to retrieve them.

The guidelines should be amended by removing all references to "irretrievable burial" in the context of deep geological disposal of nuclear fuel wastes. The term "irretrievable burial" could be replaced by "deep geological disposal" in some instances. Furthermore, we recommend adding in Section 3, a requirement to outline a contingency plan, and a cost estimate, for the retrieval of the waste if the facility does not perform safely after closure. This requirement implies the need for long-term post-closure monitoring of the facility, a requirement that the AECB foresees would be a condition of any AECB licence for such a facility. From this, there should be a requirement in the guidelines for an evaluation of approaches to pre- and post-closure monitoring which are effective, but which would not themselves pose a significant risk to the long-term integrity of the facility. In our view, an inability to monitor or retrieve wastes safely would be a serious shortcoming of any disposal concept.

While the ability to monitor the facility, and to retrieve the wastes if necessary, may seem to be contrary to the deep geological disposal concept, it is in our view a necessary element of protection-in-depth. We recommend that the ability to monitor and retrieve wastes should be one of the factors in the evaluation of alternatives to deep geological disposal. Irretrievability should not be an assumed condition. Section 3.4 should be modified accordingly.

## Part II - Detailed Comments

### Additional Topics

Discussion of the groundwater chemistry, and its spatial and temporal variations, is important to the integrity of the waste form and waste container. This topic should be included in the guidelines. A request for a discussion on estimated groundwater "ages" and origins based on water chemical and environmental isotope compositions should be added. A section should also be included on the precision and accuracy of groundwater pH and eH measurements which are the driving force variables for many chemical processes that are expected to occur in both the near and far-fields, and which are notoriously difficult to measure reliably in the field. The effects of these factors, and uncertainties in knowledge of the factors should be assessed by the proponent.

The EIS guidelines include several issues on temporal scale considerations; however, spatial scale issues should also be assessed. For example, the proponent should discuss the scales of groundwater flow that typically occur in the Canadian Shield, and relate these flow systems to the scale of the

repository (2 km by 2 km). The proponent should discuss the extent to which the various flow systems will need to be characterized to demonstrate safety, and the quantities, types, and spatial distributions of data that will be required for these characterizations. The data needed to demonstrate safety will reflect on the feasibility of the concept and the costs to implement the concept.

The proponent should be requested to identify appropriate approaches to quality control and quality assurance programs in those areas that are particularly important for ensuring health and safety if the concept is implemented. The ability to develop and implement such programs is an essential component in the viability of the concept. However, fully detailed programs are not needed at the concept phase.

#### Technical Items

In section 3.513 (The Vault System), issues regarding the performance of the buffer as a barrier should be developed to the same level of detail as is done for the other barriers. The guidelines should request the proponent to provide the range of expected emplacement properties for the buffer or the backfill materials. Similarly, the proponent should be asked to assess the performance of the buffer in preventing or limiting radionuclide releases from the emplacement holes under expected and abnormal post-closure conditions.

In section 3.54 and in the modelling sections (Sections 3.514, 3.522 and 3.532), the EIS Guidelines ask the proponent to justify decisions made in building conceptual models for the various aspects of the concept, and the EIS Guidelines raise the issue of parameter uncertainty. However, the EIS Guidelines should require the proponent to try to quantify uncertainties in conceptual models. If uncertainties in conceptual models overwhelm uncertainties in parameters, the proponent should be requested to investigate a range of possible conceptual models for each of the various aspects of the concept, rather than selecting only one set of conceptual models. The proponent should investigate models with varying degrees of complexity. A clear statement, with justification, is also needed to specify when uncertainties are "irreducible" and what effect this may have on confidence in the concept.

Many of the technical issues raised in the guidelines focus on a detailed scientific description of repository conditions as opposed to an assessment of safety. For example, at the bottom of page 11 (Section 3.513, last point in second paragraph), the proponent is asked to evaluate the creation of fractures in the rock mass surrounding the mined openings. AECL should be requested to assess the potential for such fracturing to impact on vault performance. Similarly, in the section on rock mass and groundwater properties (Section 3.521), AECL is asked to discuss methods to identify and characterize fracture zones. AECL should be asked to evaluate the conditions under which a fracture zone away from or through the repository could reduce safety to an unacceptable level.

AECL should be requested to show how the simulations used in the performance assessment, can discriminate between a good site and a poor site. AECL should



then use this information to derive the criteria for rejecting or accepting a site, as mentioned in the section of the guidelines on site characterization.

AECL should be requested to show how using observations and studies of the natural environment and more theoretical studies using mathematical modelling to evaluate the concept can be used in a complementary fashion to enhance confidence in the concept. Natural analogues in particular have an important role to play and should be used extensively.

Since no site is specified as part of the concept, the use of the notion of "site-specific data" needs to be clarified. We suggest that what is intended is the use of data which is representative of possible sites in Canada.

The various elements of the multiple barrier system need to be integrated with site selection, site characterization and regional studies in such a way that the interrelationships are clear. In particular, characteristics which are particularly favourable or unfavourable to repository performance should be clearly stated. This approach will allow maximum flexibility during any future siting process.

Some aspects of transportation are site dependent, e.g. the mode of transport and transport routes. AECL should be asked to evaluate all potential modes of transport, including transport by water.





1991-08-19  
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Environmental Assessment Panel  
Reviewing the Nuclear Fuel Waste  
Management and Disposal Concept,  
Federal Environmental Assessment Review Office,  
13th floor, Fontaine Building  
200 Sacre-Coeur Blvd.,  
Hull, Quebec  
K1A 0H3

Honorable Members of the Panel:

Here are my comments on the draft EIS Guidelines.

I. Re 3.32 Rationale for Irretrievable Burial

Because the environment cannot be expected to remain static during the period of management responsibility, the proponent should outline its vision(s) of the future indicating general influences, trends, and projections that provide a context for assessment of the general acceptability of the proponent's waste fuel management philosophy. For example, what is the projected role for nuclear energy during the next 100, 200, and 500 years? What sort of assumptions and conditions would make immediate burial of used nuclear fuel advantageous/disadvantageous? What is the likelihood that the buried nuclear fuel will be disinterred during the next 100, 200, or 500 years, assuming a thriving nuclear industry for the period under consideration? Is it desirable to make special provisions for possible future retrieval of the buried fuel?

II. Re 3.9 Cost Analysis

Aspects of the economic impact of consumption of non-nuclear, non-renewable resources are covered in sections 3.512 and 3.82; nevertheless, the EIS should contain additional information on the overall quantities of various non-nuclear, non-renewable materials used and consumed over appropriately convenient and well-defined time spans, the relationships to Canada's and the world's known exploitable reserves of these materials, economic assessments of supply/demand, contingency plans in the event of shortages, and the effects of activating these contingency plans. Tabulations or charts are preferable where possible.

Ideally, the same should be done for the viable storage alternatives in section 6 to the extent possible.

III. Re 4.23 Health

The requirement to evaluate the physical and psychological health of the population(s) should be qualified to ensure that the data is relevant and does not infringe upon civil rights. The proponent could be asked to evaluate special health issues pertaining to potential affected populations, to evaluate the adequacy of the



available epidemiological data to establish a baseline health datum, and to propose methods of dealing with any inadequacies these regards.

#### IV. Re 4.27 Lifestyle

The reference to "spiritual factors" seems out-of-place in an EIS document. Since it seems inappropriate to ask an economic organization to intrude upon such esoteric matters, the reference to "spiritual factors" should be deleted or replaced by a more concrete term such as "religious" or "other social". In the event that people wish to volunteer input about spiritual matters, they should have an opportunity to do so during the public hearings; however, the initiative for introducing these sorts of matters should remain with the public.

I wonder, too, whether the special reference to "aboriginal . . . factors" is necessary.

#### V. Re 6. ALTERNATIVES TO IRRETRIEVABLE BURIAL

The storage options include surface storage options, shallow-underground options, and deep-underground options. ~~Some~~ Some underground options have a soft-rock and a hard-rock version. The shallow-underground options include: (1) surface options built just below the surface, (2) deep-underground options built near the surface, and (3) unique options such as near-surface borehole emplacement (which involves a relatively retrievable burial underground but no tunnelling).

Ideally, the most suitable storage alternative should be identified for comparison with the AECL Concept. Comparisons between storage and disposal should consider fuel recycling and non-recycling scenarios and should include comparison of feasible transport distances, number of transport casks required and transport time frames, geological and siting implications, costs, health risks and environmental hazards.

Since some extended storage alternatives have the option of being converted to permanent disposal, the feasibility of the use of such a system should be addressed in some detail. Furthermore, since extended storage alternatives could be located in Southern Ontario (that is, outside the Canadian Shield), the EIS should address the feasibility of storage-disposal in this geologically different medium. Of particular interest would be the increased earthquake effects, the potentially improved material compatibility by getting away from the acidic rock of the Canadian Shield, the proximity of greater population centers, and projected future population growths.

Yours truly,

*A. I. Ranni*

A.I. Ranni







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19 August 1991

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Federal Environmental  
Assessment Review Office  
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Hull, Quebec  
K1A 0H3

Attention: Ms Susan Toller

Dear Ms Toller

Re: Nuclear Fuel Waste Management  
Environmental Impact Statement

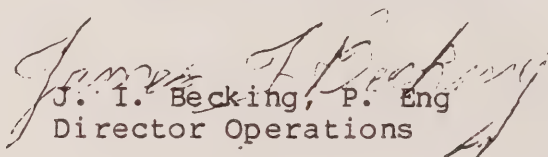
Further to your circulation of guidelines for the preparation of an Environmental Impact Statement published by the Environmental Assessment Panel reviewing nuclear fuel waste management disposal, I wish to advise that I have reviewed the document in question and still fail to understand why it is necessary to use irretrievable burial on spent nuclear fuels.

It would seem to me that although the storage facilities should be heavily sealed, there should be some means of access in the event of unusual occurrences or the development of future technology which might make it possible to render these materials inert. It is important that we always remember to keep our options open.

Secondly, it would seem to me that there could be some provision for a radioactive warning detection system placed at each barrier into the disposal storage areas so that if it became necessary either to close barriers prematurely or open them to gain access for some reason or other, those people involved in the process would perhaps be given immediate warning of a bad situation and in fact, in some cases, the use

of closed-circuit television with zoom lenses to pick up the warning device, might be possible. This then begins to have the capability of perhaps protecting someone from overdoses of radiation.

Yours truly

  
J. I. Becking, P. Eng  
Director Operations

JIB/js

cc: A/Co-ordinator Environmental Services Ctee  
EMU Planning Officer







Comments on Draft (June 1991) Guidelines for the Preparation  
of an Environmental Impact Statement

ENVIRONMENTAL ASSESSMENT PANEL REVIEWING  
THE NUCLEAR FUEL WASTE MANAGEMENT  
AND DISPOSAL CONCEPT

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for the  
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Review Office

August 30, 1991

## INTRODUCTION

The terms of reference for this review, as stated in the contract with Supply and Services Canada, are:

The Contractor will review the draft guidelines for the preparation of an Environmental Impact Statement (EIS) and advise the Panel on whether this document addresses concerns relating to the economic implications of a possible nuclear fuel waste management facility in a fair and equitable manner. If the Contractor determines that the questions regarding the economic implications of the Atomic Energy Canada Limited concept are not formulated in a clear and comprehensive manner that would lead the proponent to provide information helpful to the review, he should suggest means to improve the wording of the document.

This has been interpreted to mean that "economic" should be understood broadly, as "socio-economic", including social and cultural variables as well as economic variables. I have viewed the terms of reference as not restricting me to particular sections of the draft Guidelines, such as sections on the "human environment", and have commented on all material of economic and socio-economic relevance, wherever this occurs.

## COMMENTS ON SPECIFIC GUIDELINES

### 2.3 The Need for Long-Term Management of Nuclear Fuel Waste - Risks to the Health of Natural and Human Environments

#### Guideline:

The EIS should discuss the need for long-term management of nuclear fuel waste and the current risks to the health of human and natural environments incurred by the present management of nuclear fuel waste. The proponent should identify all means through which nuclear fuel waste may directly or indirectly impact on these environments, and the groups within these environments which are considered to be of greatest risk and why. The discussion should include a definition of risk and health; recipients of risk from radiation exposure; explanation of effects of radiation on the natural and human environments, including probability and magnitude of risks; evolution of health regulations related to radiation, including national and international radiation limits; the relationship between the presence of radiation and the incidence of health problems; methodology used for risk and health assessment; risks resulting from social (eg. human intrusion) geological and environmental factors; identification of risks related to accidents and worst case scenarios (eg. unexpected major leakage); perceived versus actual risk; and pathways and linkages within our social

system which enable people to understand and internalize risk perceptions.

#### Comments:

Several matters in the foregoing raise the question of where the Panel's responsibilities end and where the Proponent's begin. The Panel as a government appointed body should be in a better position than the Proponent to define risk and health and outline the evolution of health regulations. It seems to overlook that the Proponent is a private entity subject to government policy and government's interpretation of its policy..

### 3.32 Rationale for Irretrievable Burial

#### Guideline:

The implications of the proposed Concept on future generations and the present society's responsibilities to these generations should be discussed. The advantages and disadvantages of irretrievable burial versus retrievable storage, and implications regarding overall risk, should be explained.

#### Comments:

The requirement, as it stands, may be too general. The removal of nuclear fuel wastes from one place for disposal at another implies a redistribution of the risks associated with the wastes - risks that will apply to future as well as present generations.

With the proposed repository in place, people in the vicinity of Bruce, Pickering, and Darlington may be less at risk than currently, and people at some wilderness location will be more at risk.<sup>1</sup>

Rather than being asked to discuss "responsibilities to future generations" (which is a very vague concept), the proponent should:

- demonstrate that irretrievable storage in another location reduces risk to the present host population by more than it increases risk to the population which hosts the irretrievable storage site. This should be done on both a total population and individual basis. It should include populations which are directly involved with the storage and removal of nuclear fuel wastes and people at large within a

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<sup>1</sup> It might be expected that there will always be fewer people at the wilderness location than at the nuclear reactor sites, so in a purely quantitative sense (risk x population), total risk may be reduced. However, this is not to say that risks to particular individuals, such as on site workers, in either location will be reduced commensurately.



significant radius. Both somatic and genetic effects of exposure to radiation should be taken into account.

- demonstrate that the increased risk at the irretrievable storage site is below levels that are considered a hazard.
- present arguments on why risk levels at both locations should in future remain below levels believed hazardous (assuming, of course that they are below hazardous levels at the current storage site).

"Responsibilities to future generations" is too vague. As well, it is unfair to the proponent to ask it to think about future welfare without suggesting a time horizon. Should it be the next two generations? The next three? The next one hundred?<sup>2</sup> Moreover, as a body representing or trying to determine the public interest, it would seem that the Panel should tell the Proponent how the Proponent should think about responsibilities to future generations and what standards would be used to determine whether behaviour is responsible or not. It should not rely on the Proponent, a private entity, to suggest standards by which its behavior should be judged.

Both the Panel and the Proponent may have to take into account that various publics may look upon their responsibilities to future generations differently. Mainstream Canadian society has, I believe, tended to take a relatively short-term view, leaving future generations to solve the problems they inherit. Native people, who could comprise a significant proportion of the host population, often take a much longer view. For example, one Indian First Nation in the Yukon sees its planning and responsibility horizon as seven generations from now.

There may also be significant differences in how various publics perceive immediate risks. Current host populations have lived with the temporary storage of spent nuclear fuel for many years, and probably do not ordinarily give much thought to the risks of doing so.<sup>3</sup> The host population of the irretrievable storage facility might conceivably also become "risk oblivious" over time, particularly if the project yields substantial benefits. However, in the case of one group, the native population, the new risks are likely to be viewed as compounding risks already arising out of the contamination of lands, waters and foodstocks, leading to a heightened overall feeling of vulnerability and insecurity. The

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The United States Environmental Protection Agency (EPA) horizon is 10,000 years. Whether so long a period - which if projected backward would take human history back to the stone age - can have any meaning is highly doubtful.

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This is a general observation. It is not intended to deny that particular groups are extremely concerned about the problem.



native population would likely see the additional risks as cumulative, not isolated.

### 3.33 Criteria and Assumptions

#### Guideline:

The Proponent is asked to outline the regulatory criteria with which it must comply and the criteria it has established, etc. This should include: definitions of safety and acceptability; criteria and assumptions for safety, and technical and social acceptability; criteria and assumptions for responsibility to future generations; the ability of the concept to meet the proponent's own criteria for safety and technical and social acceptability.

#### Comments:

While it would seem reasonable to ask the Proponent to state its own internal criteria and assumptions, several of the foregoing would seem to lie within the public domain, and would therefore seem to be the business of government. Should not the process be one in which the Panel refers to the government's regulatory criteria and requirements for safety and responsibility (as set by the AECB and other responsible bodies), and then asks the Proponent to demonstrate how these will be met? If suitable, universally applicable criteria and requirements do not exist, it would seem to be the business of government, not the Proponent, to provide them.

### 3.4 Irretrievable Burial Alternatives

#### Guideline:

In undertaking benefit-cost comparisons of various alternative methods of irretrievable burial, the Proponent should present the "relative importance of social, economic and environmental criteria in judging the acceptability of alternatives...".

#### Comments:

The comment is similar to the previous one. Should not the Proponent be given some indication of how the government sees the relative importance of social, economic and environmental criteria? It seems unfair to ask the Proponent to stick its neck out by asking it to undertake prioritization at the beginning of a process that is largely about the determination of priorities. Why not simply have the Proponent demonstrate that it can do sound benefit-cost analyses that take economic, environmental and social factors into account and allow the subsequent debate before the Panel to suggest priorities?

### 3.6 Site Characterization

#### Guideline:

The proponent is asked to define an ideal site and the likelihood of finding an ideal site. The description should integrate aspects of the natural and human environments. In the case of multiple candidate sites, the description should indicate procedures for ranking sites, including involving the public in these procedures.

#### Comments:

The requirement that the description should integrate aspects of the natural and human environments is not easy to understand. I would interpret it in the following way: Given the nature of project, the primary requirement would seem to be one which pertains to the natural environment: finding a site that would completely isolate nuclear fuel wastes and remain geologically undisturbed forever. However, because it must remain uncertain that a site will forever remain undisturbed and not all risks can therefore be eliminated, a secondary requirement (one pertaining to the "human environment") would seem to be that the site should be as far from present and potential sites of human activity and population as possible (assuming that this does not unduly increase risks relating to transportation). The ideal site from the perspective of the natural environment may not be the ideal one from the perspective of the human environment, and the site that is finally selected will be a compromise. The ranking process by which this site is selected is the issue, and inevitably requires the consideration ("integration") of both natural and social factors.<sup>4</sup>

Is this what is intended? If so, the Proponent might simply be asked to state the specific factors that it would take into account in ranking a site from a) an environmental standpoint and b) a socio-economic standpoint. It should also be asked how it would then use the two sets of rankings to come up with a single ranking.

One other matter may also require consideration: Native and non-native people exploit fish and game resources that migrate

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The United States National Research Council suggests that uncertainty, rather than something to be eliminated (an impossible goal), should be lived with and viewed as a critical determinant of the whole process of finding and implementing a means of disposing of nuclear fuel wastes. "Confidence in disposal techniques must come from a combination of remoteness, engineering design, mathematical modeling, performance assessment, natural analogues, and the possibility of remedial action in the event of unforeseen events. There may be public or political pressure on implementing agencies to provide absolute guarantees, but a more realistic -- and attainable -- goal is to assure that the likelihood of unforeseen events is minimal, and that the consequences of such events are of limited magnitude." (National Research Council, Commission on Geosciences, Environment, and Resources, Rethinking High-Level Radioactive Waste Disposal, National Academy Press, Washington, D.C., July 1990, p.15)



extensively, and which could, perhaps seasonally, risk exposure to contamination from a depository site. The Proponent might be asked how this would be dealt with and, indeed, how other geographically extensive effects which could affect remote populations might be dealt with.

Taking all of the foregoing into account, appropriate wording might be: "In defining an ideal site, the Proponent should consider the required characteristics of the natural environment for safe burial, the location and extent of human activity at and near potential sites, and the safety of more distant human populations which exploit fish and game resources which may at times be located near the site."

### 3.61 Natural Environment

#### Guideline:

Among others, this requires "a procedure for relating the natural environment aspects of the site description to human environment aspects..."

#### Comment:

It is difficult to know what the proponent is expected to do. The matter is surely not as simple as finding that because the natural environment contains logs, the human environment may contain loggers. Yet without further explanation, this is how it might be interpreted.

It must also be considered that the human environment is no longer locationally or site specific. A treed environment may contain loggers in its immediate vicinity, but its human environment may extend across the continent and include many thousands of people who both favor logging and people who oppose it. In some cases, there may not be a significant local human environment (there may be very few people), but global concerns about that environment may be of great significance (eg. IBP sites, wilderness parks, etc.).

Moreover, the views of local people who depend on the exploitation of a resource for their livelihood can be in serious conflict with the views of people at large who place other values on the resource. There are many examples: current clashes between environmentalists and loggers in British Columbia; the animal welfare and rights movements and the use of animals in research, etc. It is unlikely that the Concept will escape this form of conflict since local people may want it for the benefits it could bring, but many people at large will be suspicious and fearful of nuclear waste disposal and will place a high value on wilderness.

The Proponent might therefore be asked to explore (not "demonstrate", since that might be asking it to do something it

## Comments:

The Concept could result in a project of a scale roughly comparable to a large diameter northern pipeline or James Bay II. Even if done with great sensitivity, the management of a project of such a scale will have a large impact on people and their communities.

According to material from AECL (Managing Canada's Nuclear Fuel Wastes, 89-05-01), the design, construction, operation, closure and decommissioning of a disposal vault could cost about \$9 billion, spread over a 70 year period, for 191,000 tonnes of used fuel, the amount expected to be produced in Canada by 2035. During the 10 year construction phase, a work force of about 1,100 would be needed. During the 40 years that the waste is emplaced in the vault, about 600 full time employees would be required.

It is not known how carefully the \$9 billion figure was derived, nor whether it includes any estimates for community improvements. However, the costs of moving heavy construction equipment over local roads, and of accommodating some 1,100 construction workers for a period of 10 years and 600 operational workers for a period of 40 years would be substantial. It should also be noted that 10 years, the length of the construction phase, is a substantial period in the life of any community. Construction cannot therefore be regarded as a "short-term" period.

There may be several options with respect to the accommodation of personnel, particularly long term operational personnel. One may be to emplace such accommodation into an existing community; another to build a new community; still another may be a "fly-in - fly-out" rotational scheme. The proponent should be asked to develop material on these options, drawing on examples where each has been used. A consideration might be whether the first repository will be located in an area that is also likely to be the locale of the second, the third, and so forth. If this were even a remote possibility, the development of permanent, perhaps dedicated, townsites would make a great deal of sense.

An important consideration will be the extent to which the Proponent is prepared to deal with the public honestly and openly. The public will know that with a project of this duration, size and nature, not everything can be predicted, planned or designed in advance and that considerable engineering and redesign will have to be done during construction and probably even during operation. The Proponent might be asked how it intends to involve the public throughout, and how it intends to publicize significant changes in design and engineering.<sup>5</sup>



really cannot do) how it would weigh local uses of, and concerns about, particular sites against the concerns of the larger public, including people who have never seen the site, but who nonetheless may value it as wilderness or in some other way.

### 3.62 Human Environment

#### Guideline:

The requirement here is that a "discussion of the investigation and characterization of human environment aspects of candidate sites should include the following: a demonstration that appropriate techniques have been developed, proven and are available for sufficient description of all relevant characteristics and interactions occurring in the human environment of the candidate sites; a procedure for relating the human environment aspects of the site description to natural environment aspects; and the criteria, and the hierarchy in which the criteria are applied, for acceptance or rejection of candidate sites on the basis of socio-economic characteristics of the site, and the ability to describe these characteristics.

#### Comments:

Prima facie, the best site from a human standpoint would be the one that yielded the highest benefits and least risks. However, one might have to look further and determine to whom the benefits accrued and on whom the risks fell. For example, a facility near a north Ontario town might be viewed as high on benefits and low on risks by the local non-native population, but as low on benefits and high on risks by the native population. The Guidelines should therefore be more specific in ensuring that the Proponent made distinctions, as appropriate, among various groups within the general public.

### 3.71 Project Management

#### Guideline:

This includes: private and/or public corporation operation in various sub-systems (sub-contracts?) and the impact on regulatory requirements to control and enforce safety, health and environmental regulations and standards; description of conflict resolution and proposed dispute settlement procedures to resolve differences between agencies, communities and contractors; scheduling of project phases, construction activities, and construction and improvement of major community infrastructure elements, as well as overall target completion dates; short and long-term community involvement; and methodology for ensuring adequate notification to future generations of location, contents and monitoring records of repository after closure.



The policies and strategies normally employed by on-site management in dealing with local people are important. For example, oil and gas exploration companies located at Tuktoyaktuk on the Beaufort Sea during the late 1970s and early 1980s differed markedly in their approaches to the local community: One major company was viewed as too dominant and intrusive; another as perhaps too remote and inaccessible. The Proponent should be asked to examine its own record in this regard and indicate how it would relate to communities in the vicinity of the repository.

Given the length of the construction and operations periods, it is probable that disputes will arise between the proponent, its contractors and local residents. How disputes should be settled, and how costly and delaying litigation might be avoided by the use of alternative dispute resolution methods, should be given considerable attention by the proponent and the panel. Several environmental controversies involving native people have been resolved through negotiations, or with the assistance of mediation services. As an example, "environmental mediation" has been used with some success by the Energy Resources Conservation Board (ERCB) of Alberta (See Appendix A). In the United States, the use of alternative methods of resolving disputes with native people has gained important ground, particularly in the northwest, where state governments have established a recent record of litigating less and negotiating more with Indian tribes over issues such as water rights.

### 3.72 Project Activities

#### Guideline:

The proponent is asked to address the need for changes in local infrastructure to support the Concept.

#### Comments:

The requirement might be more specific, asking that the Proponent examine a variety of examples in which companies have interacted or jointly planned with municipalities, and to indicate which of a number of possible models it might follow.

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can raise questions about the validity of the technical approach, as well as the competence of the risk analysis that was used to justify it. Conversely, when foreseen events occur, they lead to questions about why they were not prevented. The credibility of the project team suffers in either case, but it probably suffers more when the organization has understated the risk or uncertainty. (National Research Council, Commission on Geosciences, Environment, and Resources, Rethinking High-Level Radioactive Waste Disposal, National Academy Press, Washington, D.C., July 1990, p.15)

### 3.73 Labour Requirements

#### Guideline:

The EIS should contain information concerning the labour required for the various phases of the Concept, and related health, accommodation and transportation plans, including the following: employment and personnel policies related to the utilization of local, regional and/or migrant labour force; labour force size and skills required during various project phases; training programs (especially for the local/regional labour force); schedule of migrant worker influxes during the various project phases; worker safety and health programs and facilities to respond to accidents or emergency medical needs; need for local or remote, permanent or temporary, living accommodation for migrant labour force; and transportation of migrant workers to and from the work site.

#### Comments:

It is unlikely that a large proportion of the construction labour force could be hired locally, but local participation could be considerable during the operations phase, given its length. However, given the technical nature of the nuclear industry, and the risks inherent in an underqualified labour force, bringing local people up to standard would seem to require more than a few weeks of even months of training. The proponent should be asked to explore alternative ways of developing a labour force that has a substantial regional component. Are target employment participation objectives a good idea? What targets should be assumed for construction and operations (or how would the targets be set?). Would on-the-job training be feasible? How might the Proponent use incentives (bursaries, scholarships, employment guarantees) to encourage young local people to build careers around its activities?

### 3.74 Emergency Planning

#### Guideline:

The discussion of emergency planning should include: an emergency response plan; accident scenarios; financial responsibility; and training.

#### Comments:

The Proponent should be asked to identify and categorize the full range of emergencies that might affect its own labour force, the surrounding public and the public at large. It should be asked to distinguish between emergencies it could normally handle itself and those which might require assistance from provincially and federally based emergency response capabilities.



### 3.83 Operation of the Transportation System

#### Guideline:

Among other matters, this calls for discussion of: proposed transport routes, and criteria for acceptance and rejection of routes; public involvement with decisions re choices of modes and routes; risks related to all aspects of transport; safety record; volume, frequency and timing of shipments; and measures to address public concern regarding transport and methods of keeping the public informed re modes, routes.

#### Comments:

In addressing the frequency and timing of shipments, the Proponent should be asked what effect might delays have on overall operations, costs and safety (eg. a prolonged strike or lengthy detours due to road construction)?

Given probable negative public reaction to the sharing of public transport systems with nuclear fuel waste carriers, the Proponent could be asked to examine the pros and cons of a dedicated system, the feasibility of such a system, its costs, etc.

### 3.84 Labour requirements (for the construction and operation of the transportation system)

#### Guideline:

This should include the use of local and outside workers; initial and ongoing training; and measures to ensure safety.

#### Comments:

If it is to share the roads with nuclear fuel waste carriers, the public will undoubtedly want maximum assurance that the transportation of nuclear fuel wastes is in competent hands. The requirement should therefore include a discussion of the minimum qualifications of workers, by type, involved in the transport of the wastes, the availability of such workers, etc. It might also be important to know whether it is usual for Concept labour to be unionized (though finding parallels would admittedly be difficult), and, if so, what contingency plans might be needed in the event of a prolonged strike affecting any part of the Concept. Would they all need to be designated as essential, preventing them from striking? (Is it conceivable that nuclear fuel waste truckers would behave like ordinary truckers, pulling into truck stops for meals and perhaps a night's sleep, or would some quite different and far more rigorous way of operating be required? Is it conceivable that the transportation of nuclear fuel wastes would be contracted out? If so, what problems might arise with regard to ultimate responsibilities?)

### 3.9 Cost Analysis

#### Guideline:

The EIS should provide estimates of the total cost of the Concept as well as estimates for its major components, indicating sources for funding. The total cost should be compared to the cost of alternative nuclear waste management options, to the extent possible. The cost of monitoring, possible mitigation and compensation should be included. The EIS should also contain a risk benefit analysis of key components of the Concept indicating their costs versus reductions on risk to the environment.

#### Comments:

The Guideline suggests two ways of approaching cost. One would start with an estimation of the internal costs of the project to the Proponent, including all of the costs of planning, financing, building, operating and decommissioning the facility. As suggested by the requirement for an estimate of total costs, such internal costs could be extended to include costs external to the Proponent, such as highway or municipal improvement programs due to the project but not paid for by the Proponent. However, the Panel might wish to make clear how far such estimates should extend. Should they include the costs of limiting the use of a wilderness area by others or disrupting the lifestyle of cottagers, for example?

The other approach is that of risk-benefit analysis, where the concern is with matters that are far less tangible and where estimates are far more difficult. Here the basic notion is that risks to the public bear social costs, and to the extent that the Concept reduces risks, social benefits will accrue in the form of social cost reductions.

There are several considerations:

- What is the nature and magnitude of the risks at present storage sites?
- How do these translate into social costs?
- Will an expenditure of several billion dollars on the repository reduce the risks and hence associated costs significantly or insignificantly?

Risks to the public would accrue mainly in the area of health. But here it is questionable whether there are sufficient data on radiation-related morbidity and mortality to provide a basis for risk-benefit estimates. As well, current data on morbidity and mortality levels near reactors and waste storage sites may contain



no indication of ultimate risks, since a long time may pass before hazards become apparent.<sup>6</sup>

This is not meant to suggest that risk-benefit estimates should not be attempted, even if their value can be questioned. However, given the conceptual difficulties and data problems inherent in such estimates, the Proponent, before undertaking risk-benefit analysis, should be given clearer guidance on what the Panel perceives to be at risk, on how much analysis it requires, on the difficult methodological question of how the leap from risks to social cost reductions should be made, and on what time horizon the analysis should employ. Panel members would, after all, have to have such issues clear in their own minds to put themselves into a position to critically examine the Proponent's risk-benefit analyses and estimates. Panel members would also have to have some notion of what levels of risk are acceptable before they were in a position to pass judgement on estimates by the Proponent.<sup>7</sup>

It should also be considered that a definitive risk-benefit study would be of great value to everyone, a matter which raises the question of whether the Proponent, which might bias the study in its favor, should undertake it, or whether the study is not properly the responsibility of a public agency.

It is recommended that the subject of risk-benefit should be given separate consideration from that of project costs in the Guidelines. In addition to treating it in the manner suggested above, other perspectives could come into play: for example, what benefits versus what risks will accrue to the repository host population?

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A question is the significance and separability of the radiation effects of nuclear fuel wastes, which are not presently a large source of radiation in comparison with other sources. The Hare report refers to findings by Sir Edward Pochin for the Nuclear Energy Agency of OECD: "...the overall population exposure to radiation from the nuclear industry is small by comparison with that received from natural sources - about 6 per cent of the latter .... It is also small by comparison with that received from the use of X-rays and radiological therapy in medicine ...." The Hare report concludes that the health hazards of disposed-of irradiated fuels or reactor wastes will be virtually nil, but that the safe disposal of such fuel and wastes is essential for public health. In the view of the Hare committee, the risks lie in the act of disposing, not in the fact of permanent disposition. (A.M. Aiken, J.M. Harrison, and F.K. Hare (Chairman), The Management of Canada's Nuclear Wastes, Report of a study prepared under contract for the Minister of Energy, Mines and Resources, 31 August, 1977, pp.27 & 30)

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The United States standard, established by the Environmental Protection Agency (EPA) is that a repository must meet radionuclide release limits that would result in less than 1,000 deaths in 10,000 years. Whether such an absolute standard for so long a period can have any meaning, or even any use as a design parameter is highly questionable. (See: National Research Council, Commission on Geosciences, Environment, and Resources, Rethinking High-Level Radioactive Waste Disposal, National Academy Press, Washington, D.C., July 1990)

#### 4. BASELINE ENVIRONMENT

##### Guideline:

Since a site has not been identified at this stage of the Concept development, the proponent should explain the approach it would take to summarizing information regarding the baseline natural and human environments.

##### Comments:

The proponent might also be asked to indicate the source of its approach, precedents, with what success it has been used, and what its limitations are.

#### 4.1 Natural Environment

##### Guideline:

The Proponent is asked to define, in concept, the natural environment that would be considered suitable for siting. This should include the identification of valued ecosystems components, indicators and sensitive species; food chains and radiation pathway mechanisms; and the context within which significance of changes in valued ecosystem components, indicators, and sensitive species can be determined.

##### Comments:

How "Valued Ecosystem Components" (VECs) should be valued raises methodological questions of interest to the social analyst. I assume that such components would include wildlife resources. While I cannot comment on the appropriate method of evaluating such resources from an ecological point of view, I would point out that what is of interest from an economic standpoint is not primarily the value that scientists or the remote public place on a resource, but the value of that resource to people who use it to make a living (and who must consider how they would conserve it if they are to continue to make a living).

In the case of the Goose Bay EIS, even though local economic importance was one of the criteria used in the proponent's method, no estimates were made of how much monetary and non-monetary income local people currently obtained from a particular resource or how much they would lose by a decline in the availability of that resource. While, at times, the Proponent used economically relevant concepts in describing the value of a resource, the whole matter of regional and local economic value was left obscure, and no real basis was provided for estimating the local/regional



economic trade-offs involved in the project insofar as wildlife resources were concerned.<sup>8</sup>

While I would not suggest that this is the place for assigning a users' value to wildlife resources, the Guidelines might go further in stating the basis for the valuation that is required here.

If wildlife resources are to be considered outside of the context of human use, it might make more sense to employ a concept such as "Ecosystem Components at Risk" (ECARS). I understand that Dr. Nick Novakowski has written a brief analysis of the role of, and the differences between, VECs and ECARS in conjunction with his work on the Rafferty-Alameda project.

#### 4.2 Human Environment

##### Guideline:

The Proponent should define the human environment that would be considered suitable for siting and should explain the study strategy that would be used to investigate the baseline environment that exists prior to interactions between the Concept and the receiving human environment.

##### Comment:

I have always been disturbed at the use of the term "human environment". It seems to me that the natural environment is the human environment, or is at least a good part of it, the remainder being what artificial things people do to the natural environment to modify it to meet their needs, and how they organize themselves for this purpose. I have felt that it is unfair to proponents to use the term without providing a clear definition of what it is supposed to mean. It is true that the remainder of 4.2 deals with various components of the "human environment", but it does so in a disjointed, piece by piece fashion which does not suggest a coherent, meaningful, overall model.

I would suggest that such a model should include three broad areas of human concerns, values and institutions: The social, the economic and the cultural. Put most simply, the social bears on who is included in the group, and on how peoples organize themselves in law and politics to survive and continue; the economic bears on how people organize themselves for production, consumption and exchange; and the cultural bears on how people understand themselves via their languages, history, customs,

religions and myths. How these fit together and change for a particular people are complex questions, but questions which must nonetheless be dealt with when people are faced with something as disruptive as a major construction project and as profoundly disturbing as what to do with spent nuclear fuels.

As it now stands, material in the Guidelines on the human environment consists of a series of poorly organized requirements which will likely turn up poorly organized responses. How issues and questions might be organized under the kind of model I have outlined in the above paragraph is suggested in Appendix B.

It must also be considered that the Concept is likely to be located in a remote area of the Canadian Shield inhabited by two distinct peoples, Canadians mainly of European origin and Canadians of native ancestry. In developing baseline information and undertaking its impact assessment (even in concept), the Proponent should be required to recognize the distinctiveness of these groups. Impacts could differ considerably, perhaps being generally positive for the non-native community, and negative (or at least viewed as such) for the native community.

The proponent should also be expected to demonstrate an awareness of current constitutional, legal and political issues relevant to native people. This matter is not academic; it is intensely practical. Improper attention to it could set the actualization of the Concept back many years. As illustrations of the recent status of such matters, I attach two short papers which I did for another project earlier this year. (Appendices C and D)

#### Guideline:

The EIS should explain the sources of information used to determine information concerning, and indicators of: demographics, employment, health, economics, land use, infrastructure, lifestyle, and noise.

#### Comments:

In the case of many outlying regions of Canada, information on these subjects is scarce, not very useful, or nonexistent. The proponent may need to conduct special studies and surveys. How far should it be expected to go in detailing these? What contingency measures would it take if it encountered non-cooperation from segments of the resident population (as in the case of consultants for DND in the examination of low level flying out of Goose Bay)?

#### Guideline:

The monitoring of the human environment should be described. The subjects monitored, the agencies conducting monitoring, and the methodology used should be stated. Temporal and spatial boundaries



of monitoring studies should be identified. Public involvement and notification of results should be explained.

**Comments:**

It is very difficult to know what is to be monitored here. NIMBY will be a very major factor unless the host population can be persuaded that the facility, and transportation to it, are absolutely safe, and unless local benefits are substantial. The host population must become convinced that the risks are so slight that monitoring is a sensible precaution, and not something that keeps an ever present danger barely in check.

Rather than describe a monitoring system bearing on people, the proponents should instead be asked how it intends to work with the host population along every step of the way to ensure that the population becomes convinced that there will be no danger to it or is at least fully aware of the risks. This is more than "public relations". It is involving local people in the very design of the project itself. It would also appear to be more than consultation, as this has traditionally been conducted. As put in submission to the panel by Ontario Indian groups in support of joint decision-making: "The term "consultation" has lost any validity in our communities, as it has been interpreted to mean that government agencies will tell us what they intend to do with out land and the First Nations must listen."<sup>9</sup>

It must also be considered that monitoring is the responsibility of public agencies, not the Proponent. Would the Panel consider addressing guidelines to such agencies asking them how equipped they are to monitor public health and safety, among other issues?

**Guideline:**

Scenarios and models would be helpful in explaining the characteristics of the human environment. All assumptions and limitations should be stated.

**Comments:**

This is one (of several) instances in the Guidelines in which the Panel is being unfair to the Proponent in not giving it a more precise idea of what is wanted. Several potential models that could be useful suggest themselves, and the proponent might be asked to develop each. For example:

- A model of the frontier economy, highlighting the respective roles of, and conflicts between, resource based industrial activities and native subsistence harvesting, and how the Concept (which is a little like a large mine in reverse) would affect these roles and conflicts. (For one possible way of understanding the economy of the frontier, see Appendix E.)
- Scenarios of labour build-up and build-down during various phases of the Concept.
- Scenarios of various ways of accommodating the labour force during construction, operation and demobilization.
- Scenarios of project - community interactions.

The point is that the Panel should not merely request models in general, but should be quite specific with regard to what it wants the Proponent to produce. In giving the Proponent an open book, the Panel is doing itself a dis-service as it may have great difficulty in making sense of whatever the Proponent will choose to provide by way of response.

#### 4.21 Demographics

##### Guideline:

The study strategy should consider the demographics of potential host communities/regions. The discussion should include: present populations in terms of race, age, gender, births, deaths, etc.; and population trends.

##### Comments:

For the sake of the English language, could not "demographics" be changed to "population size and characteristics" or even "demography". (My dictionary says "demographic" is an adjective. Can an adjective be pluralized?)

"Race" should not be used. It is an ambiguous term, and many people regard it as offensive. In any event, genetically determined factors such as the color of one's skin or the flatness of one's nose have no bearing on the language one speaks or the lifestyle one pursues. "Ethnicity", which identifies the individual with the cultural group he or she belongs to, is the preferred term.

Questions bearing on location and mobility of the population might be added pertaining to: the degree to which populations live in urban centres versus in small rural holdings or villages; the extent to which segments of the population (eg. the young) have



tended to move out of the region, at what rate and why; whether out-migrants have returned, and why.

#### 4.22 Employment

##### Guideline:

The study strategy should consider the employment situation of potential host communities/regions, including: sectors of employment; income levels; resident or non-resident labour force; employment trends; and local training facilities.

##### Comments:

Presumably, asking the Proponent to consider these matters relates to government policy concerning the promotion of local and regional employment. If this is the case, the policy objectives should be clearly stated so that the proponent has a reason for collecting baseline information and a set of principles around which it can organize the information. As well, given the policies in place (eg. the Canadian Jobs Strategy), the proponent should be asked how it would go about integrating its own work on employment related matters with the work of federal and provincial government agencies.

In addition to the factors listed, factors of importance internal to the region would include local education levels; local employment patterns ("permanent", "seasonal", "temporary", etc.); and sources of income during periods of unemployment (eg. UIC, welfare). Factors of importance external to the region would include union hiring practices (ie. to what extent would these permit local hire?); education requirements for the various jobs in the construction or operations phase; and trades entrance requirements.

#### 4.23 Health

##### Guideline:

The study strategy should consider the health of the potential host communities/regions, including: natural background radiation; the physical and psychological health of the population(s); the ability to measure physical and psychological health; and the monitoring of baseline health.

##### Comments:

It is suggested that radiation related health effects deriving from the removal and storage of nuclear fuel wastes, while not entirely excluded here, should be dealt with mainly as part of the risk-benefit analysis (3.9). Section 4.23 could then concentrate mainly on other health impacts arising out of the project. Some of these

might derive from the possibility that the repository might be used as a means of disposing of nuclear wastes other than fuel wastes. Others might derive from the growth of towns or the creation of new towns in wilderness regions. Previously isolated native populations might find the adjustment to higher activity and population levels difficult. Alcoholism, family violence and social disintegration could arise as significant problems.

#### 4.2.4 Economics

##### **Guideline:**

The study/strategy should consider the economics of the potential host communities/regions, including: the economic base; tax base; tax revenues; and personal income levels.

##### **Comments:**

The focus would appear to be on some limited aspects of the "Local Economy", which might serve as a better title for the section than "Economics".

The reason for the section is questionable, since significant aspects of the "economic base" are already dealt with under "Demographics", "Employment", "Land Use", and "Infrastructure", and "personal income levels" are presumably partly included under "income levels" in section 4.22, "Employment".

The only things that appear to be left are "tax base" and "tax revenues". Why these issues are being raised may be unclear to the proponent. Is the repository expected to generate significant local taxes or grants in lieu? Presumably, the repository will be located in a remote area in which the most likely forms of government are the Local Improvement District and the Indian Band, neither of which generate significant tax revenues of their own.

#### 4.25 Land Use

##### **Guideline:**

The study strategy should consider land use patterns of potential host communities/regions, including: current land use plans; land use legislation; land use trends; valued areas (heritage, economic, natural, archaeological, spiritual); aboriginal views on land use; and aboriginal land claims.

##### **Comments:**

I have already commented on the need for the proponent to become sensitized to constitutional/legal issues bearing on native rights to land.



I would suggest that "aboriginal views on land use" be omitted. If native people still use the land for hunting and gathering, and/or if there is a native claim on the land, native views of the land will emerge from native people themselves. The Proponent is probably not in a good position to interpret native views in any event. If it attempts to do so, it will likely damage its relations with native people, who would likely be suspicious of the Proponent's intentions and who are fully capable of speaking on their own behalf.

The important thing is not "views", but the degree to which constitutional (claims, treaties) and harvesting rights may exist, the degree to which native land use continues, and how existing rights can be dealt with (avoidance of certain areas, compensation, settlement of a claim, etc.). However, even these are uncertain waters for a Proponent to venture into, and should perhaps be the business of the Panel and its technical support staff to establish.

#### 4.26 Infrastructure

##### Guideline:

The study strategy should consider the infrastructure of the area surrounding the Concept, including: housing; transportation networks; education facilities; health services; recreational facilities; utilities; and energy supply.

##### Comments:

It is notable that educational facilities are to be considered here, but local/regional educational attainment levels have not be dealt with anywhere.

#### 4.27 Lifestyle

##### Guideline:

The study strategy should consider the current lifestyle of the residents of the potential host communities/region, including: values of resident population(s); cultural and spiritual factors, including aboriginal cultural and spiritual factors; economic and life-sustaining activities; and recreation activities.

##### Comments:

The Proponent has already been asked to provide information on "economic and life-sustaining activities" elsewhere, and could perhaps include something on recreation (eg. cottages, boating, sports hunting) here. However, it would not seem to be the business of the Proponent to discuss the "values of resident population(s)" or "aboriginal cultural and spiritual factors". Surely the purpose of the Panel's hearings will be to enable people

to speak for themselves! Moreover, there is probably nothing that has been more damaging to a past succession of corporate proponents than their clumsy attempts to describe the "lifestyles" and "traditional pursuits" of native peoples. If you want to get a proponent into trouble, asking it to get into these areas is a certain way of doing it. The Panel itself, in directing these questions to the Proponent, could get into trouble. Public groups, particularly native people, could legitimately ask: "Why are they asking those guys about us?".

## 5. IMPACTS ON THE ENVIRONMENT

### Guideline:

Since a site has not been selected, the proponent is asked to explain the approach it would take to summarizing information regarding the impacts of the Concept on the natural and human environments.

### Comments:

It is rather strange that the proponent would be asked to do no more than "summarize" when surely a full explanation of how it would arrive at impacts would seem called for. Rather than a "summary", what would seem required here is a framework or model that would include, and, to the extent possible and reasonable, integrate, the various ecosystem components (including human ones) affected by the Concept and indicate the relationships and dynamic transfer systems among them.

### 5.1 Impacts on the Natural Environment

#### Guideline:

The proponent is required to explain the study strategy that would be used to investigate the short-term and long-term impacts of the Concept on the natural environment, including: the impacts on valued ecosystem components, indicators, and sensitive species; and the significance of changes in valued ecosystem components, indicators and sensitive species.

A further requirement is that the monitoring of the impacts of the Concept on the natural environment should be described. The subjects monitored, the agencies conducting monitoring, and the methodology used should be stated. Temporal and spatial boundaries of monitoring studies should be identified. Public involvement and the communication of results should be explained. ... Public consultation methods with respect to mitigation should be described.



### Comments:

With respect to consultation, the Proponent might be asked to examine actual models for consultation between other Proponents and affected communities. It might also be asked to give explicit recognition to the concept that different groups may require different approaches - that, for example, you may not be able to reach native people if your point of contact is the municipal council.

The matter of "valued ecosystem components" has already been dealt with under 4.1. What the Proponent might be asked to do here is examine various methods of valuation from both an ecological and economic perspective, and suggest methods which might best serve impact assessment.

On the matter of monitoring, a methodology for the specific monitoring of impacts on particular ecosystem components and linkages is essential, together with a means of applying the monitoring results to mitigation and operating regimes. Aspects which are to be handled by the Proponent versus those that must be undertaken by public agencies, should also be identified. However, while the Proponent might be asked to suggest the requisite division of monitoring responsibilities in the EIS, a final recommendation on who monitors what should be the business of the Panel, after it has heard from all parties, including government agencies.

## 5.2 Impacts on the Human Environment

### Guideline:

The proponent should explain the study strategy that would be used to investigate the short-term and long-term impacts of the Concept on the human environment. The EIS should describe the impacts of the Concept resulting from normal operation and accident scenarios.

The study strategy should examine the following socio-economic aspects of the human environment: demographics, employment, health, economics, land use, infrastructure, lifestyle, and noise.

The consideration of impacts should include the examination of risk, probability, magnitude, timing, geographic extent, and significance of impacts. Prediction of impacts should be accompanied by the assumptions upon which they were based. Levels of confidence or uncertainty should be stated.

Cumulative effects should be addressed. The proponent should provide a definition and description of cumulative effects, and should identify the temporal and spatial boundaries of the effects, as well as the key elements of the environment that could be affected.

The monitoring of the impacts of the Concept on the human environment should be described. The subjects monitored, the agencies conducting monitoring, and the methodology used should be stated. Temporal and spatial boundaries of monitoring studies should be identified. Public involvement and notification of results should be explained.

Scenarios and models would be helpful in explaining the impacts of the Concept on the human environment. All assumptions and limitations should be stated. Previous projects with similar short-term effects on the human environment might provide relevant examples to enhance the reader's understanding of the impacts of a concept.

Mitigation and compensation measures, their effectiveness and any residual impacts should be outlined. Public consultation methods with regard to mitigation should be described.

#### Comments:

The problem of how the section on "human environment" should be organized to make sense from a social analysis perspective has already been addressed in comments on 4.2. The question of overlap among subjects such as "demographics", economics and lifestyle has also been addressed there and is dealt with further in Concluding Remarks, below.

What is essential here is not how little bits-and-pieces of the "human environment" would react to the project, but a more comprehensive, holistic approach within which all social, economic and cultural variables can be examined.

Rather than have the Proponent address socio-economic impacts hypothetically in this part of the EIS, it might be useful to have it address (undertake) two or three case studies that could indicate various ways in which impacts could occur, ways in which they could be monitored, and ways in which they could be resolved. The Canadian and American frontiers contain many examples - eg. Tumbler Ridge, McMurray, Thompson, Goose Bay and Schefferville in Canada. Particularly well documented is the case of Valdez during the construction of the Trans-Alaska Pipeline. The point is, the more that can be learned from actual experience, the less that has to be addressed theoretically.

#### 5.21 Demographics

##### Guideline:

The study strategy should examine the impacts of the Concept on demographics of the potential host communities/regions, including: an influx of non-resident labour into host communities during



construction; the creation of a new community, if necessary; and a boom and bust scenario.

#### Comments:

Again, it would seem more useful to examine and learn from particular cases than to address this issue in the abstract.

### 5.22 Employment

#### Guideline:

The study strategy should consider the impacts of the Concept on the employment situation of the potential host communities/regions. This should include an examination of the impacts of the Concept on: employment opportunities during the various stages of Concept implementation, eg. pre-construction, construction, operation, closure and post-closure; local employment incomes; non-resident versus resident labour force; availability of skilled labour force; and local training facilities.

#### Comments:

A problem here, commented on further in Concluding Remarks, is the time spans may be too long to be meaningful in terms of human experience. Construction may last for ten years, operations for 40 years, and the project as a whole for 70 years.

The Proponent might perhaps be asked to concentrate on the initial 20 years, that is: the construction and early operations period. It is during the early stages of this period that effective policies will have to be implemented. If they are, the longer term will probably look after itself.

On the basis of experience with analog projects, the Proponent might be asked what specific policies it would implement to involve local labour during construction and what longer-term plans might be initiated for the operations phase. It could be asked how it might work with unions (assuming they were significant) in developing local hire, training and certification programs. Since there could be a significant native population in the vicinity, it should be asked how it would involve native people.

### 5.23 Health

#### Guideline:

The study strategy should address the impact of the Concept on the health of the potential host populations(s). Health impacts should not be restricted to mortalities; in the case of the exposure to radiation and radioactivity, the risks of total cancer, hereditary

effects and other effects should be described. The discussion should include the impacts of the Concept on the following: natural background radiation; non-radiological health impacts associated with the construction, operation, and closure of the waste management facility; non-radiological health impacts associated with the transportation of nuclear fuel waste; non-radiological health impacts related to an increase in local traffic; health impacts from radiation exposure to worker during construction, operation closure and remedial repairs; health impacts from radiation exposure to workers during transportation of nuclear fuel waste; health impacts from radiation exposure to surrounding public during transportation; health impacts from radiation exposure to future generations in the area surrounding the facility; psychological stress resulting from concerns regarding health impacts ensuing from nuclear fuel waste management facility; and perceived versus actual health impact.

#### Comments:

As in the case of 4.3, it is assumed that the concern here is mainly with health effects not related to radiation from nuclear fuel wastes. These could derive from a number of sources, but an important source could be the implantation of a new, numerically significant population into a former wilderness area inhabited by native populations which had lead relatively isolated and undisturbed lives - a scenario repeated many times on the Canadian frontier, often with tragic results for native people in terms of alcoholism, family violence and general social disintegration. It would seem worthwhile to have the Proponent explore previous examples of this scenario and develop principles that it would apply to monitor, minimize and mitigate the disruptive impacts of its own activities.<sup>10</sup>

#### 5.24 Economics

##### Guideline:

The study strategy should examine the short-term and long-term economic impacts of the Concept on the host community/region and to the Canadian public during the various stages of Concept implementation, including: the impact of the Concept on the tax base; the impact on tax revenues; the impacts on personal income levels; the impacts on surrounding property values; the impacts on

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Though native people will undoubtedly speak for themselves on this matter, it is important that the Proponent (and the Panel) understand the very special relationship between native people and their land and environment. This relationship is so strong that if the land and animals are debased or destroy, native people see themselves as diminished not only economically, but at the very core of their being. For an in-depth exploration of the relationship, and of what happens when it is broken, see: Peter Armitage, Homeland or Wasteland? Contemporary Land Use and Occupancy among the Innu of Utshimassit and Sheshatshit and the Impact of Military Expansion, Submission to the Environmental Assessment Panel Reviewing Military Flying Activities in Nitassinan, Naskapi Montagnais Innu Association, January 31, 1989.



tourism, mining and other industries; compensation for health effects; compensation for any loss in property values; compensation for any loss resulting from a possible decline in tourism or other industries; compensation for any decline in hunting, trapping, fishing or traditional way of life, including aboriginal traditional way of life; and the financing of infrastructure improvements required to support the project.

#### **Comments:**

Again, short-term and long-term should be defined in terms of how people and communities experience change and assign significance to time, and not in "life of the project" terms.

#### **5.25 Land Use**

##### **Guideline:**

The study strategy should consider the effects of the Concept on the land use of the area surrounding the proposed facility, evaluating the following: predicted changes in land use as a result of the Concept; and effects of Concept on aboriginal land claims.

##### **Comments:**

While the Proponent should be aware of aboriginal claims issues, anything it may say on the subject would likely be challenged by native groups and might jeopardize its future relations with native claimants. The best approach might be to not ask the Proponent to stick its neck out and let claimant groups make their own statements.

#### **5.26 Infrastructure**

##### **Guideline:**

The study strategy should discuss the impacts of the Concept on the infrastructure of the surrounding area. the proponent should identify any requirement for infrastructure improvement that would be necessary to support the Concept, and the financial responsibility for any additional maintenance or provision of new services, including an evaluation of the following: housing; transportation networks; education facilities; health services; recreational facilities; utilities; and energy supply.

##### **Comment:**

Again, the time-scales should be those within which communities and municipalities usually work.

## 5.27 Lifestyle

### Guideline:

The study strategy should examine the impacts of the Concept on the lifestyle of the surrounding populations, including: effects of Concept on the values and lifestyle of host communities/regions; and effects of Concept on aboriginal values and lifestyle.

### Comment:

While the Proponent should assess impacts on recreation (eg. cottages, boating, sports hunting), going beyond such relatively practical matters could land it in serious trouble. There is probably nothing that has been more damaging to a past succession of corporate proponents than their attempts to deal with matters pertaining to aboriginal people, particularly matters such as values and spiritual beliefs.

## 7. SITE SELECTION PROCESS

### Guideline:

The proponent should suggest a plan and process for selection of a facility site and transportation routes, should its Concept be determined to be safe and acceptable, including: identification of community decision-making structures and processes for the incorporation of these decision-making structures into the site selection decisions; the integration of socio-economic and biophysical criteria in the site selection process; and the use of compensation.

### Comment:

See comments on 3.6. As well, should a guiding principle for site selection be that there will be only one repository at the chosen location, or should it be envisaged that one locale could house several repositories?

## CONCLUDING REMARKS

1. The Guidelines do not appear to give sufficient recognition to the inclusion of present wet and dry storage as part of the Concept. Even when the repository is in place, it is possible that storage at reactor sites will continue, though on a more limited scale. To what degree, and how, will impacts be diminished at the reactor sites?
2. The Proponent is often asked to provide information that is not well defined or delimited. For example, under 4.27, it is asked to consider the current lifestyles of residents of



the potential host communities/regions, including "values of resident population(s)". Under 4.25, it is asked to say how it would provide information on "aboriginal views on land use". Under 4.2, it is being asked to provide scenarios and models. Requests so broad and sweeping are not only questionable in their fairness to the Proponent, but could result in a large array of unstructured, incoherent and perhaps ultimately unmanageable information.

3. Not helping matters is a substantial fragmentation of topics that are closely related and clearly belong together if coherent information is to emerge. For example, under 4.22, the Proponent is to consider "sectors of employment" and "income levels". Under 4.24, it is to consider the "economic base". Under 4.25 it is to consider "land use trends". And under 4.27, it is consider "economic and life-sustaining activities". Such fragmentation may be even more serious in Section 5. It is difficult to see how a structured, holistic view of impacts could emerge given such a bits-and-pieces approach.
4. The Guidelines ask the Proponent for information without making clear the policy reasons for wanting such information. Especially where the reasons may not be obvious, the Proponent should be told why information is being requested. For example, the Panel must not just ask for "demographics", it must give the Proponent a sense of why, in terms of government concerns, the issue is important. Similarly, requirements bearing on future generations raise ethical questions which the Proponent, as a private entity, should not be expected to address without guidance from the Panel on the policy concerns. It should be told both how many generations should be considered and the nature of our responsibilities toward them.
5. A problem which appears to plague the Guidelines as a whole, not just the socio-economic parts, is that of time-scales. On page 2, we are told that

"Short-term" and "long-term" will be used throughout this document identify ranges of time. Short-term refers to the time period of planned human activities at the proposed repository. Long-term refers to the time period after the closure of the facility."

Thus one time scale - and not a very precise one - is expected to fit everything about the Concept. In actual fact, several different processes, each with their unique time scales, are implicit in it and should perhaps be disentangled:

- a. Time as it relates to natural processes: The process by which spent nuclear fuel becomes relatively harmless has a very long time-scale based on the half-lives of radionuclides.<sup>11</sup>
- b. Time as it relates to the project cycle: Suggesting that considerable planning has already taken place, AECL states that the design, construction, operation, closure and decommissioning of a disposal vault will be spread over a 70 year period, for 191,000 tonnes of used fuel, the amount expected to be produced in Canada by 2035. It further indicates that construction will take 10 years and that wastes will be placed in the vault for 40 years, suggesting that 20 years of the 70 year total life will be required for decommissioning.<sup>12</sup>
- c. Time as it relates to human processes: The way in which communities and people experience events typically embodies a much shorter time scale than either of the foregoing. In the life of any community undergoing rapid change due to a major construction project, a few months to a year may be considered short-term and five to ten years may be long-term. Anything beyond ten years is the distant future.
- d. Time as it relates to future generations: The Guidelines refer to such generations in several places without being specific as to when they will be alive. They ask the Proponent to give consideration to: "The implications of the proposed Concept on future generations and the present society's responsibilities to these generations should be discussed." (3.32); "criteria and assumptions for responsibility to future generations." (3.33); "methodology for ensuring adequate notification to future generations of location, contents and monitoring records of repository after closure." (3.71); and "health impacts from radiation exposure to future generations in area surrounding facility;" (5.23).

The point is that the distinctive temporal character of each of the foregoing should be recognized. The time scale that applies to any one of them may not be appropriate for the others. Socio-economic issues, in particular, must be looked

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11 House of Commons, Standing Committee on Energy, Mines and Resources, Nuclear Energy, Unmasking the Mystery, August, 1988

12 AECL, Managing Canada's Nuclear Fuel Wastes, 89-05-01. It should be noted that the 191,000 tonnes of used fuel estimated by AECL is approximately twice the 87,000 tonnes estimated by the Standing Committee on Energy, Mines and Resources for 2050. See House of Commons, Standing Committee on Energy, Mines and Resources, Nuclear Energy, Unmasking the Mystery, August, 1988, p.120



in terms of time-scales that mean something to people and communities. What happens over the seventy year life of a project (the "short-term" of the Guidelines, but the period since 1921 in human affairs!) is often less important locally than what is going to happen during the next few months of a construction boom, and how soon that boom will be over so that a community can settle back into a more normal routine.

6. The complex issue of equity might also be untangled into its several strands. It could be considered in terms of what might constitute an equitable return to Proponent without posing an undue hardship on consumers of nuclear energy, in terms of the equitable distribution of risks between populations that currently host nuclear fuel wastes and populations that will also host them when the repository is built (assuming some storage will continue at reactor sites), and in terms of shifting risks from present to future generations.<sup>13</sup>
7. Despite the enormous time spans associated with the phenomena under consideration, and despite the possibility that nuclear energy is here to stay, the Guidelines throughout treat the Concept as though there will only be one facility. A more plausible scenario is that there will be one repository within the next quarter century, followed by another, then another, then another, perhaps ad infinitum.<sup>14</sup> Moreover, assuming that an increasing number of reactors will have to be built, the interval between the commencement of the construction of each repository could get shorter. In the time span envisaged by some of the Guidelines - thousands and even millions of years - substantial areas of the Canadian Shield could be underlain by nuclear fuel wastes. Therefore, if it is to have any meaning at all, the Concept cannot be the single repository, but a whole sequence of repositories within some reasonable time period - eg. 300 years. To pursue this further, consideration of the Concept should not focus on the single transportation system, connecting existing reactors and a single irretrievable storage site, but a large network of vehicles moving between a growing number of reactors and repositories. While the risks posed by a single repository and its transport system may not be

13

See: National Research Council, Commission on Geosciences, Environment, and Resources, Rethinking High-Level Radioactive Waste Disposal, National Academy Press, Washington, D.C., July 1990, p.16

14

It is noted that the Panel's own Scientific Research Group raises the issue of what assumptions about the growth of nuclear power should be made. They state that the EIS must address several different scenarios with respect to the amount of high level nuclear waste that must be accommodated, including: no growth in nuclear power production and shut-down of existing facilities; major growth of nuclear power production to eg. replace fossil fuel power production. (Scientific Review Group, Draft Recommendations, November 22, 1990, Compilation of Submissions, Volume 5)

great, it would seem legitimate to wonder about the risk posed by several.

8. Some twenty-six countries now use nuclear reactors to generate electricity, and the number of reactors worldwide and countries using them is growing. Not all of these countries, indeed probably few, have extensive, stable formations of plutonic rock in which to bury nuclear fuel wastes. Canada may find itself in the enviable position of being able to safely get rid of nuclear wastes. Perhaps for the sake of decreasing the hazards from such wastes to the rest of the world, and therefore ultimately to itself, Canada might consider going into the business of importing nuclear fuel wastes from other countries. There is no suggestion that this possibility will get any coverage in the consideration of the Concept.

Ed Weick,  
August 30, 1991





APPENDICES



## Appendices 1

Appendix AAlternative Dispute Resolution<sup>1</sup>

Alternative dispute resolution arrangements are not examined in detail in this study. It is important to note however that several major environmental controversies involving native people have been resolved through negotiations or with the assistance of mediation services. Literature is now emerging on Northern Flood, Islington and Grassy Narrows and the Queen Charlotte Islands controversies which suggests that valuable comparative case studies might be undertaken. Several legal academics have begun to analyze possibilities for alternative dispute resolution in relation to native interests in Canada. In addition, the Law Reform Commission of Canada has undertaken work on alternative dispute resolution in several contexts, including environmental conflicts.

In the United States, the use of alternative methods of resolving disputes with native people has gained important ground, particularly in the northwest, where state governments have established a recent record of litigating less and negotiating more with Indian tribes. From the fishing-rights cases of the early 1970's to recent water-rights disputes, much of the recent history of Indian - government relations has involved the courts. A non-litigious approach now appears to have paid-off for Idaho, which is completing negotiations with tribes along the Snake River to divide water rights on the State's major source irrigation water, hydro power, and fish habitat. By contrast, Wyoming is reported to have taken the Shoshone and Arapahoe tribes to court over water rights on the Big Horn and Wind River basins and to have lost badly. (Dean Miller, States, Indians Learn to Negotiate, Christian Science Monitor, March 23-29, 1989)

As a Canadian example of alternative dispute resolution, a process known as "environmental mediation", has been used with some success by the Energy Resources Conservation Board (ERCB) of Alberta. This is a voluntary process in which those involved in a dispute jointly explore and reconcile their differences. The strength of the mediator lies in the ability to assist the parties in resolving

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Excerpted from Francois Bregha, Jamie Benedickson, Jackie Cheng, Ed Weick, and Don Gamble, Environmental Management Under Native Self-Government, Analysis of Options, Prepared for Self-Government Sector, Policy and Constitution Branch, Indian and Northern Affairs Canada, March 31, 1989



## Appendices 2

their own differences. He has no power to impose solutions. The mediated dispute is settled when the parties themselves reach what they consider to be a workable solution. (Christof Haussmann, Environmental Mediation: What, When and How?, Canadian Environmental Mediation Newsletter, Vol.1.No.3, 1986)

The ERCB applied the environmental management process to disputes between the Fort McKay Band and Syncrude Canada Ltd. in an effort to reconcile differences without the need for a public hearing following a 1985 application from Syncrude for new mining areas in support of new facilities at the Syncrude Mildred Lake Plant.

In the years prior to 1985, the native community of Fort McKay had experienced over 20 years of environmental and socio-economic impacts from the Suncor and Syncrude oil sands plants. For many years the relationship between the community and the plants was one of mistrust and suspicion as the community struggled to maintain its lifestyle in the face of what appeared to be an indifferent government and corporate response. While billions of dollars worth of oil were extracted by the plants within 40 km. of the community, the community itself remained mired in poverty, inadequate housing, social problems, low education and high unemployment. Residents of the community expressed concern about the deteriorating quality of the atmosphere and perceived losses of wildlife. (Jerome Slavik, Ron Wallace and Jim Boucher, Environmental Mediation in Major Oil Sands Development: an alternative Model to Resolution of Native, Corporate and Government Interests in Resource Development Approvals Processes, Energy Processing Canada, September-October, 1988)

According to Wallace and Slavik, who were involved in the process as technical experts appointed to the Fort McKay Band, the environmental mediation process consisted of the following key elements: Syncrude made available all relevant environmental data and would review this data with all relevant parties; the ERCB made available environmental, engineering and legal resources to the Band so that it could carry out an assessment; each side then met in a series of consultations chaired by the Board to review the comments or concerns identified by the Band and its consultants; each party had the right to withdraw from the process at any time, at which time the Board would initiate more traditional public hearings; and, the conclusions reached by the mediation process were submitted to the ERCB which was to incorporate them into the licensing process, thus making them binding to both parties. (Ron R. Wallace and Jerome Slavik, Environmental Mediation Between Industry and Native Peoples in Defined Energy Approval Processes, Canadian Environmental Mediation Newsletter, Vol.1.No.3, 1986)

Slavik, Wallace and Boucher (op. cit.) believe that what was most important was that the process allowed the Band to be on an equal footing with industry and government in terms of their scientific and technical capacity to effectively question and examine material

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contained in socio-economic and environmental impact assessments. The Band therefore had a means of independent verification. The Band soon established itself as credible and relevant participants in highly technical discussions concerning existing and proposed plant operations. In addition, it benefitted both in terms of environmental quality and materially: A Regional Air Quality Task Force was established; new community infrastructure was developed including a new fire hall and fire truck; new water and sewer systems with outlets to each household; a new retail complex and community hall; improved housing and roads; planning of community gasification; and a major community environmental beautification program. Slavik, Wallace and Boucher note:

"Governments also more fully recognized and realized their obligation to install community services (roads, water and sewer, electrification, gasification) comparable to that provided at Fort McMurray or in other non-Native communities in the region. This enhancement of local services was achieved in the face of an inadequate tax base in Fort McKay to finance such essential services." (op. cit., p.26)

Several things are suggested by the example of Fort McKay. One is that a positive attitude and goodwill, which would seem essential if alternative dispute resolution is going to work, can go a long way toward solving major environmental problems of a bilateral nature. To be sure, the goodwill was not strictly voluntary but imposed by the ERCB, but nevertheless, once there, it seems to have worked. Another is the value of providing expert resources to bands which could not otherwise afford them: a process such as the one described simply could not work without such resources. A third is the concept that mediation and its outcome should be part of the approvals process and should be written into the license to proceed. What is mediated is then binding.

It is not certain whether the Fort McKay process would apply to other bands. It should be noted that the Fort McKay Band was probably not in a position to halt the further encroachment of its traditional lands by oil sands development nor could it hope to restore its environment to its former state. In entering mediation, it recognized the inevitability and permanence of the changed situation. Many bands are in this position with respect to initiatives from the industrial world; their best strategy may well be to get the best deal they can, given their deteriorated circumstances. Mediation rather than confrontation might indeed be the best solution. In other cases the situation might be quite different. Bands may be regionally organized, like the Nishnawbe-Aski or the Dene, and can by political action exert enough power to put major development in question. Or they may feel that their chances are better in the adversarial process of the courts.



## Appendices 4

Appendix BWhat is the "Human Environment"?

The following is meant to be illustrative of the kinds of questions and issues which make sense in a remote area which has a mix of native and non native people.

Social Factors:

## Population Size and Characteristics

- to the extent that there are distinct ethnic groups, each would have to be discussed separately.
- Size and Growth
- Structure

## Location of Population

- to what degree might populations live in urban centres versus in small rural holdings or villages?
- how often do local people go to the nearest large urban centre, and for what purpose?
- has a segment of the population (eg. the young) tended to move out of the region, at what rate and why?
- do people who move out tend to return, and why?

## Health

- again, special problems relevant to each ethnic group would have to be discussed.
- quality of health services in potential host regions.

## Education

- again, distinguishing between ethnic groups, especially Native and Non-native.

## Social Problems

- ditto.

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## Constitutional/Political/Legal Issues

- are possible depository areas covered by Treaties. If so, which treaties, and what provisions are made for native rights to land?
- other issues defining, or bearing on, native ownership, governance, or usufructuary rights.
- how are people likely to be organized politically in the host areas (Improvement Districts, incorporated municipalities, Indian Bands, Self-governing First Nations)? What decision-making powers might they have locally? How do they make political decisions? How should they be approached?

Economic Factors:

## Land and Local Resource Use

- range of uses (eg. Native use for hunting and gathering versus Non-native use for agriculture, forestry, mining, recreation etc.).
- rural and urban use.
- potential use (eg. if metal prices rose, could there be more mining and prospecting, if farm subsidies were cut, would there be less agriculture, how likely are young Native people to continue to hunt and gather?)
- current land use plans (and prospective plans if these are in the works).
- land use legislation.
- Native claims and treaties (if applicable).
- land use trends.

## Employment and Income

- employment rate, and explanations of the rate. Employment by economic sector, distinguishing among categories such as "permanent", "seasonal", "temporary", etc. Source of income for unemployed eg. unemployment insurance, welfare.
- work experience



Cultural Factors:

## Lifestyle and Values

- are there distinct ethnic, cultural and linguistic divisions within the population - eg. as between Native and Non-native people?
- if so, are there different sets of values operative, with Native people perhaps placing emphasis on fears of environmental destruction and Non-native people on commercial gain?
- are there special linguistic, and perhaps cultural, barriers to understanding - eg. is Cree or Ojibway (or another native language) locally important? If so, what special measures will need to be undertaken to ensure that technical matters are commonly understood?
- is the history of relations between various ethnic groups good or bad?

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Appendix CNative Aspirations<sup>2</sup>**Problem**

Native people are dependent on the natural environment and are deeply concerned about its continued productivity and cultural relevance. Though they are willing to share it with non-native people, they see the environment as theirs to husband, use and pass on to future generations. They are concerned about non-native uses of the environment because these have often proven destructive and contrary to their interests, and because native people have gotten little out of them (though some Alberta Bands have benefited greatly from oil and gas exploitation - see below).

The extent to which native people can become hostile when their environment is under threat has been amply demonstrated by Temagami, Meers Island, South Moresby, the Oldman River, the Lubicon in northern Alberta, Oka and a variety of other situations.

Accountability to native people must now go much further than government assurances of preservation, protection and a few jobs from whatever exploitation takes place. For the sake of peace and justice, it must concern a successful search for methods of involving native people fully in the management of the environment and in the benefits from the use of the environment.

**Background**

Native people do not usually separate environmental objectives from others. Their concerns are comprehensive, and include their environment, their economies, their societies and their cultures. Though this may at times seem paradoxical, native people can simultaneously favor both conservation and development. On the one hand, they have lived with destruction of habitat for a long time, and believe strongly in controls on industrial development. On the other, they want a share of the wealth they have seen mining, pulp and paper, and oil companies remove from lands which they regard as theirs. They need revenues from resource projects to build and enhance their societies. Increasingly, they will raise resource revenue sharing and economic issues alongside environmental issues.

Environmental management

Models for the involvement of native people in environmental management exist under a variety of arrangements. In discussing

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2 From a background paper prepared for the Canadian Council of Resource and Environment Ministers (CCME)



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these, a distinction is needed between management powers native people have on their own lands and powers they have, or need, beyond their boundaries. This is important because traditional native lands, and the lands which many native people still harvest, are usually much larger than the lands which they actually own, and because developments on lands adjacent to native owned lands can raise major problems for native people.

The vast majority of Indians who live on reserves are subject the Indian Act. Environmental provisions of this act apply only to reserve lands and allow native people few powers of substance. The act applies laws of general application to reserves unless treaties or other legislation specifically exclude them.

Two Indian groups have negotiated non-constitutional self-government powers, including environmental management powers, outside of the context of the Indian Act. Indians in northern Quebec fall under the Cree-Naskapi (of Quebec) Act which affects eight Cree communities and one Naskapi community. It permits making laws on access and residence on Band lands, zoning and land use planning, expropriation of lands for community purposes, regulation of buildings and other structures, parks and recreation, protection of the environment including natural resources, regulation of hunting, trapping and fishing, and regulation of roads, traffic and transportation. In British Columbia, the Sechelt Indian Band falls under the Sechelt Indian Band Self-Government Act. Under this act, the Band Council may make laws respecting the preservation and management of natural resources, and the preservation, protection and management of fur-bearing animals, fish and game on Sechelt lands. It is also important to note that, under the act, by Federal and Provincial agreement the Band may be granted management powers outside reserve lands via the creation of a "Sechelt Indian Government District". [check status]

Inuit of northern Quebec have also negotiated arrangements which enable them to exercise self-government powers. Under the Kativik Act, a provincial statute, communities have become "Northern Village Municipalities" which have powers such as zoning and land use planning, parks, recreation and culture, and regulation of roads, transportation and traffic. The Kativik Act has also enabled the creation of the Kativik Regional Government, a non-ethnic government for the northern third of Quebec, which has paramountcy over the Northern Village Municipalities on matters such as the establishment of minimum standards for building and road construction, sanitary conditions, water pollution and sewerage.

Claims settlements have resulted in a variety of joint government-native arrangements which project native management powers beyond native lands. For example, Section 22 of the James Bay and Northern Quebec Agreement establishes a body, appointed by the Cree, Canada and Quebec, which has advisory powers with respect to

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the environmental and social protection regime established under the Agreement. Section 24 of the Agreement establishes a committee to oversee the hunting, trapping and fishing regime.

Claims currently under negotiation could provide models for cooperative management. For example, the Council for Yukon Indians Umbrella Final Agreement contains provision for a joint native-government Fish and Wildlife Management Board and for Renewable Resource Councils.

A variety of arrangements currently exist outside of the context of the claims and self-government. The Northern Flood Agreement deals with issues arising out of the construction of hydro electric projects in northern Manitoba. Two caribou management agreements have been signed by the Federal Government, the Territorial Governments and native organizations, as well as by provincial governments in the case one of the agreements.

Native groups have themselves taken major initiatives with respect to environmental conservation, management and planning. In this regard, the Inuit Circumpolar Conference is incorporating the recommendations of the World Conservation Strategy and the World Commission on Environment and Development into an Inuit Conservation Strategy. This represents a first attempt by an indigenous people to develop a conservation strategy that stresses the importance of traditional knowledge in resource management. (Dene Cultural Institute, Traditional Ecological Knowledge and Environmental Assessment, April 24, 1989) [check status]

It will be noted that the models which have been referred to apply mostly to native people living on, or beyond, the development frontier. Those living in densely populated, industrialized areas, such as the Mohawk near Montreal, the Walpole Island Band of Lake St. Clair, and the Musqueam of greater Vancouver present different problems and would probably require different models. An even more difficult problem is presented by the urban Indians of Winnipeg, Regina and Edmonton, many of whom are, in effect, environmental refugees from reserves which can no longer provide them with sustenance and meaning.

It should also be noted that the models refer to continuous arrangements between governments and native people, whereas, quite often, the problem is a specific issue or dispute. In such cases, native people have the rights of all citizens to appear before, or be involved with, environmental assessment panels or to take court action. However, an approach which has gained considerable momentum in recent years is mediation, which has now been used to resolve several major environmental controversies involving native people, particularly in the United States. (Dean Miller, States, Indians Learn to Negotiate, Christian Science Monitor, March 23-29, 1989) In Canada, the Energy Resources Conservation Board (ERCB) of Alberta used mediation in disputes between the Fort McKay Band and



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Syncrude in 1985. The Band was given a means of independent verification, and soon established itself as a credible participant in discussions concerning existing and proposed plant operations. What applied to Fort McKay could probably also apply to many other native communities. (Jerome Slavik, Ron Wallace and Jim Boucher, Environmental Mediation in Major Oil Sands Development: an alternative Model to Resolution of Native, Corporate and Government Interests in Resource Development Approvals Processes, Energy Processing Canada, September-October, 1988)

### Sharing in benefits

While native people want to preserve and protect the environment, they also want to benefit from its exploitation. Some native groups have already benefited substantially from non-renewable resource based exploitation of the environment. Indian Bands in the western provinces have realized large sums of money from oil and natural gas production. Royalties for the 1988 calendar year amounted to \$67 million, a figure which was greatly eclipsed by revenues a few years earlier, reported at \$270 million in 1984 and \$350 in 1985. While these revenues accrue to some 36 western bands in total, much of it goes to a limited number of bands in Alberta. Mining has also provided benefits, although these have been much smaller.

While no one could deny them such benefits, native people have themselves often questioned the compatibility of the large-scale projects with their own values. Many native spokesmen have expressed preferences for small-scale, locally manageable enterprises based on renewable resources - enterprises which provide a basis for community coherence and environmental sustainability. One band in British Columbia has now operated a 48,000 ha. tree farm for eight years. This has meant \$18 million in revenues and some 50 to 60 jobs to the band. Other west coast bands have operated fisheries related projects. Indeed, Indian bands have now assumed a leading role in salmonid enhancement on the west coast. (Rawon Academy, Environmental Management under Native Self-Government, March 31, 1989). There are many ideas about what might be done with the renewable resource sector. A 1987 study by the Inuit Tapirisat of Canada proposed a restructuring of the sealing economy. The Mackenzie Delta Regional Council in 1986 proposed a variety of projects: a supplies warehouse; trapper training; hides collection and tanning; selling smoked dried fish; community tourism; forestry projects; fisheries biological research; and fur habitat management. [better examples?]

### Significance

The arrangements cited under "Environmental management" have not meant an end to contention between governments, private development interests, and native people. This still exists on a wide range of issues. Nevertheless, the arrangements have meant the creation of

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institutions, forums and rules within which problems can be addressed and resolved. They have imposed order on situations which were formerly dealt with by the frontier ethic of simply moving native people aside and proceeding with whatever was at stake. They have recognized distinctive native interests and proscribed boundaries and behaviour. Both for governments and native people, uncertainty has been reduced around major environmental issues.

The issues dealt with under "Sharing the benefits" address native participation in the economic exploitation of the environment. With a few exceptions, the record to date has been dismal. A much greater effort is needed to ensure both that native people benefit and that economic exploitation is not contrary to native values and aspirations. While some favourably located bands will benefit from major resource development, for most the optimum solutions would seem to lie in the promotion of small scale local enterprises based on the resources native people have at hand and know how to use. Native people must play the key role in determining initiatives.

### Context

While no longer merely a hewer of wood and drawer of water, Canada is still enormously dependent on the extraction of its natural resources. All regions continue to depend on mining, forestry, the development of hydro-electric power and wilderness tourism, activities which bring governments and private firms into conflict with native people. The issue of providing means of cooperative management and native benefit is thus national in scope, though individual provinces would have to address the issues in their jurisdictions as these arise.

### Stakeholders (who owns the issue?)

The major stakeholders are provinces which are dependent on the extraction of natural resources and in which there has been little formal recognition of the native interest in the environment. However, the Federal Government is also a stakeholder out of its responsibility for native people. Native people and resource companies, are, of course, also major stakeholders.

### Implications for CCME

A national strategy for the involvement of native people in the management of the environment is needed, perhaps using already existing arrangements as models. Based on high-level native input (not merely consultation), an important part of this strategy would concern exploitation of environmental resources along lines compatible with native values.



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Appendix DAboriginal Rights<sup>3</sup>**Problem**

Existing aboriginal and treaty rights are entrenched in the Constitution, but remain undefined except as stated in specific treaties, land claims agreements and court judgements. Some treaties have not, according to the courts, been honoured by governments. Government protection, conservation and development of environmental resources may have to proceed under difficult and ambiguous circumstances as native people pursue a variety of strategies to define and extend their aboriginal rights.

**Description**

Metis and non-status Indians are included as "native people" in the Constitution Act, 1982 along with Indians and Inuit.

The Act (in Section 35) recognizes two sources of Native rights.

- treaty rights, which include rights which exist or may be acquired by land claims agreements. These rights, in most cases acquired over a century ago, are very limited in terms of benefits and powers to native people. For example, in the case of Treaty 3 signed in 1873 with the Saulteaux, Ojibway and others in Ontario west of the Great Lakes and in southeastern Manitoba, government, undertook to provide reserves (up to one square mile per family of five) and schools, and to control liquor traffic. Indians were given the right to hunt, trap and fish on surrendered lands (55,000 square miles) subject to Government regulations. "Treaty presents", annual payments (perhaps generous then, but a pittance now), ammunition and suits of clothing for chiefs were also promised. The rights conveyed by land claims agreements (only three agreements have been concluded so far: the James Bay and Northern Quebec Agreement, the Northeastern Quebec Agreement, and the Inuvialuit Final Agreement) provide for much larger land areas and compensation payments. As well, they not only convey harvesting rights, but also rights to participate in the management of wildlife and the environment in general. However, neither the treaties nor the claims (thus far) convey rights to self-government. Except as specifically provided in particular claims agreements, federal, provincial and territorial laws of general

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application remain in force both in treaty and claim settlement areas.

- existing aboriginal rights, which the Constitution recognizes and affirms. The nature of these is unclear: the First Ministers Conferences called for in the Constitution Act, 1982, failed to define them. The First Ministers were especially reluctant to consider rights to self-government, which Native leaders pressed. There may be more First Ministers Conferences focusing on the definition of these rights, or this may have to await court judgements. Meanwhile, the degree to which Native people can operate out of their own rights as opposed to rights delegated by the federal and provincial governments will remain unclear.

Even though aboriginal rights remain undefined, that governments will have to tread carefully with respect to them in developing and applying legislation and regulations is clear from a recent landmark Supreme Court judgement:

- In R v. Sparrow, the Crown had contended that the aboriginal right to fish had been superseded by law and that Indians must therefore abide by the regulations it put forward. However, on May 31, 1990 the Supreme Court of Canada upheld a BC Court of Appeal ruling that an aboriginal right to fish is not extinguished merely by its being controlled in great detail by regulations under the Fisheries Act. The Court ruled that nothing in the Fisheries Act or its regulations demonstrated a clear and plain intention to extinguish the Indian aboriginal right, and that historical policy on the part of the Crown can neither extinguish the existing aboriginal right without clear intention, nor, in itself, delineate that right. However, the Court stated that government policy can regulate the exercise of that right but such regulation must be in keeping with s. 35(1) of the Constitution Act, 1982, meaning that government must demonstrate that its regulation is not an infringement on aboriginal rights and, to the extent that it is an infringement, it must demonstrate that the regulation is for the common good.

The principles in Sparrow are already seeing application:

- In R.v Flett, 1987, the Manitoba Provincial Court applied the Sparrow decision to support the conclusion that to the extent that the Migratory Birds Convention Act purports to extinguish the rights of treaty Indians to hunt migratory birds year round for food it is inconsistent with s 35(1) of the Constitution Act, 1982, and of no force or effect. The decision was appealed.

There will undoubtedly be many further applications of Sparrow. The Supreme Court decision requires that governments must justify



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any interference with aboriginal rights. This suggests that any legislation without such justification can be challenged before the courts. This would presumably include legislation that is protective of the environment as well as legislation which promotes development (eg. mining, forestry and tourism legislation).

It should be noted that the Sparrow judgement indicates that aboriginal rights are primary in character. However, the only right it specifically deals with is the right to fish. One can expect attempts to obtain affirmative judgements on other kinds of rights as suitable cases arise.

The Federal Government must not only be wary of infringing on aboriginal rights, it must be protective of such rights and perhaps even pro-active with regard to them. In Guerin v. R., the Supreme Court of Canada found that the Federal Government has a special fiduciary relationship with native people. This relationship includes native lands, in which, the Court held, native people have an independent legal interest predating the Royal Proclamation of 1763. It implies a federal responsibility to protect the Indian interest from exploitation. In Sparrow the Supreme Court refers to this responsibility as being "trust-like, rather than adversarial", suggesting that a greater watchfulness by the Federal Government on behalf of the native interest in land is in order.

Recent cases suggest that all governments will also have to be careful that their legislation and regulations are not in conflict with rights conveyed in early treaties and agreements:

- In Simon v. The Queen, a Micmac relied on provisions of the Treaty of 1752 as a defense to charges under Nova Scotia legislation of unlawful possession of a shot gun cartridge and of a rifle during the closed season. The Treaty provided that the Indians should continue to enjoy "free liberty of hunting and fishing as usual...." The Supreme Court of Canada concluded that this provision, being part of an unterminated and unextinguished treaty, had the effect of exempting Simon from prosecution.
- In R. v. Sioui, the Supreme Court of Canada, in 1990, upheld the right of Huron Indians to use conservation lands in Jacques Cartier park in Quebec. The Indians were charged with cutting down trees, camping and making fires "in places not designated". The Court's decision was based on the continued validity of a treaty which the Hurons signed with General Murray, who represented the British Government, in 1760.

Native people have pressed the issue of the constitutional entrenchment of self-government, but without success. Self-government issues and arrangements are dealt with more fully as part of the issue of "Native Aspirations".

## Significance

The foregoing suggests:

1. Probable court challenges to federal and provincial legislation by native people with the object of extending the principles in Sparrow. Such challenges are likely to occur in regions which are not covered by treaties and where it cannot be argued that native rights have been superseded by law. The most probable regions are British Columbia and the Yukon (both Sparrow and Guerin involve the Musqueam Band in BC).
2. The use of treaties, including pre-Confederation treaties, to address the rights of specific native groups. Much of Canada is covered by a variety of treaties and agreements with Indians. The exceptions, in which challenges are least likely to be feasible, are: (1) B.C. where there are only a very small number of (pre-Confederation) treaties. (2) The Yukon, where only the southeast corner is included in Treaty 8. (3) Much of the NWT, where only the Great Slave Lake area and the Mackenzie Valley are covered by Treaty 11. Quebec appears to be something of a special case. It is unlikely that pre-conquest treaties would be of use to native people since these would likely have been invalidated by the British conquest. The 1760 treaty in which General Murray gave special rights to the Hurons is unlikely to affect other tribes. However, it is always possible that there are other ancient treaties or agreements which could surface. As well, it is probable that interpretations and implementation of the James Bay and Northern Quebec Agreement and the Northeastern Quebec Agreement, and the self-government legislation arising out of these agreements will continue to pose problems.<sup>4</sup>
3. A greater concern on the part of the Federal Government that legislation bearing on the environment does not infringe on aboriginal rights and that it meets its fiduciary responsibilities.
4. Less cooperative relations between the Federal Government and the provinces with regard to provincial actions which could impinge on aboriginal rights to land. The Federal fiduciary obligation with respect to native lands first referred to in

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<sup>4</sup> A settlement valued at \$9 million has been made between Ontario and the Ojibway of Manitoulin Island for lands not paid for when originally surrendered in the Manitoulin Island Treaty of 1862. Of the \$9 million, \$7.2 million is for economic development and \$1.6 million is for the 32,800 ha. of land originally ceded to the Crown. The Manitoulin Island Treaty is only one of many made with Ontario Indians for very low, even negligible, compensation. It may be indicative of what Ontario, the inheritor of the British Crown in the province at confederation, may have to pay out over the next several years. Some 2,500 Indians will benefit. (Laura Eggertsen, "Manitoulin native settlement hailed as model", Ottawa Citizen, December 6, 1990, p.A5)



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Guerin and again in Sparrow is now likely to be taken very seriously by Federal officials.

### Context

The Supreme Court has now firmly indicated the direction it will follow on aboriginal rights. In light of this, all governments will have to be careful that their environmentally oriented legislation and actions do not infringe on such rights. A wide spectrum of government concerns could be affected. Particularly vulnerable may those intended to protect wildlife or to promote particular activities such as mining and forestry.

Least vulnerable are parts of Canada in which relatively clear and unambiguous treaties and claims agreements have converted aboriginal rights to specific rights (that native people did not get enough in their specific rights is a separate issue). Most vulnerable are parts of Canada which are not covered by treaty or a claims settlement, or where governments have operated on the assumption that ancient treaties, such as the Treaty of 1752 with the Micmacs, have been superseded by law.

### Stakeholders (who owns the issue?)

Most fundamentally, the issue arises out of the historic failure to convert generalized aboriginal rights to specific rights via clear and binding treaties and via political means such as constitutional conferences. Under s. 91(24) of the Constitution Act, 1867, the Federal Government is responsible for Indians, and lands reserved for Indians. The fact that a major national problem remains indicates that the Federal Government has not fulfilled its responsibilities.

The continuation of the problem into the future will affect all groups. Indians, attempting to define and extend their rights, will selectively take advantage of the opportunities that present themselves. The application of environmentally oriented planning and legislation is bound to be disrupted and frustrated. Both the protection of the environment by governments and the development of natural resources by the private sector will suffer. The local, regional and even national economy will be affected. Relations between native and non-native Canadians will deteriorate as native people take demonstrative action to back up legal and political initiatives.

### Implications for CCME

The solution to the problem, as it has been identified, is a greatly increased Federal effort to resolve native claims and outstanding aboriginal rights issues. The shame of the military stand-off at Oka and a spate of blockades and other disruptive actions across the nation may have forced a beginning. In



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September, 1990, Prime Minister Mulroney announced a new "Indian agenda" which is to have four aspects: land claims; the economic and social conditions on reserves; the relations between aboriginal peoples and governments; and concerns of aboriginal peoples in contemporary Canadian life. On land claims, there would be three parallel initiatives: the acceleration of the settlement of specific claims; the honouring of legal undertakings regarding land transfers to treaty Indians, and the acceleration of negotiations on comprehensive claims. The government will no longer limit itself to handling six claims at any one time, and will consider other innovations such as regional and province wide negotiations. What this "agenda" will mean in practice, especially in light of a worsening Federal fiscal situation, remains to be seen. (Globe and Mail, September 26, 1990)

The provinces should not be allowed to overlook that, while the responsibility is largely Federal, their historic attitudes to native rights to land, and native rights in general, have not been helpful and were in fact the major factor in the failure of three constitutional conferences on aboriginal rights. Native people are unlikely to give up their aspirations. A failure to give ground on native rights now will lead to far greater and more costly problems in future. A failure of political solutions will undoubtedly lead to a sequence of well planned, nationally orchestrated court challenges and disruptive actions which could significantly reduce the ability of governments to govern.

Appendix EThe Frontier Economy<sup>5</sup>

The conventional approach to the economy of a frontier region such as northeastern Quebec and Labrador is to treat it just as one would treat any other economy. This approach involves seeing the economy as a single, integrated and interactive whole. Much like the economy of the industrial heartland, it is viewed as consisting of sectors, of varying degrees of interdependence, which in turn consist of a number of industries. Some sectors, such as the food producing sector, might be located mainly in rural areas, but most are urban. In combination, the sectors would transform resources to either intermediate or final output which would in general move out of the region, though some would be consumed regionally. How effectively these sectors operated in combination is measured by standards such as gross regional output, employment, and income per capita.

In this view, aboriginal subsistence and commercial harvesting fall into very small sectors of the frontier economy in comparison with mining, hydro-electric power, retail and wholesale trade, and public administration and defence. Moreover, if the linkages between the regional economy and broader provincial or national economy are brought into the picture, aboriginal harvesting diminishes even further, interacting with the larger economy only via small, declining industries such as the fur industry. On the other hand, regional mines and hydro power installations appear as vital components of large national industries. Because of their great social value and high productivity, the expansion of these industries is favoured even if this means undermining the small, regional industries upon which aboriginal people depend.

This view of the frontier economy was dominant until roughly the mid-1970s, when an alternative view first began to gain acceptance via processes such as the Berger Commission and the land claims movement. This new view began with the premise that it is fundamentally wrong to treat the frontier economy as a single, integrated whole, since it is really comprised of two distinct economies, each having a profoundly different origin in history, and each following its own purposes, logic and mode of production.<sup>6</sup> In the industrial economy, frontier production is seen as taking place in a distant hinterland which must be exploited for the resources which can be fed into the activities of the centre. In

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Excerpted from: Ed Weick, Socio-economic Consultant, A Review of the Socio-cultural Effects of Low-Level Flights on Aboriginal People in Quebec and Labrador, for Indian and Northern Affairs Canada, January 31, 1990, pp.39-41

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The development economist will recognize this supposed new view as the dual economy model that originated in theorizing on the economic nature of the underdeveloped world.



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the aboriginal subsistence economy, the frontier becomes "the homeland". It is the very centre of the world, where all life and all activity -- economic, social cultural, and spiritual -- takes place. The motives of the two economies are entirely different: The industrial economy is concerned with commodity production for profit; the aboriginal economy with own-use or "domestic" production, though there is also a long tradition of minor commodity production via the fur trade, sealing, commercial fishing and crafts. In the industrial economy, economic activity is highly specialized and is viewed as essentially isolated from other functions of society. In the aboriginal economy few distinctions are made between economic and other spheres of life.

There is now considerable overlap between the two economies on many of Canada's frontiers. The aboriginal economy is dependent on the importation of many goods that it cannot produce. It must therefore obtain cash to purchase them. Wage employment in the industrial economy has become a major source of such cash. On the other hand, at least since the Supreme Court verified the existence of aboriginal rights to land in 1973, it has become more difficult for the industrial economy to treat the frontier as its private resource hinterland and to ignore that it is also the homeland of aboriginal people. Even though the balance between the two economies is still a delicate one, there is now growing evidence that the aboriginal economy and the industrial economy can co-exist, and indeed that the aboriginal economy can now no longer survive independently of the industrial economy.

These paragraphs on the nature of the frontier economy are not intended as a lesson in economics. Their purpose is to provide the reader with a sense of how the Proponent's economic information will be assessed by the reviewer and probably by other interested parties. It is not expected that the Proponent will necessarily share the views which have been expressed. However, if the EIS is to present a useful picture of present and potential economic activity in the region, the Proponent's material should indicate a coherent understanding of the nature of the regional economy. The information it provides should be more than bits of data strung together or there is something important missing.











Environment

Building 2  
139 Tuxedo Avenue  
Winnipeg, Manitoba, CANADA  
R3N 0H6

September 4, 1991

Susan Toller  
FEARO  
13th Floor, Fontaine Bldg  
200 Sacre-Coeur Blvd  
Hull, Quebec  
K1A 0H3

Dear Ms Toller:

Re: Guidelines For The Preparation Of An Environmental Impact  
Statement - The Nuclear Fuel Waste Management And Disposal  
Concept

The Draft EIS Guidelines have been reviewed by a provincial  
Technical Advisory Committee and I would submit the following  
comments to you on behalf of the Committee:

SECTION	COMMENT
3.33	the description should include provincial regulatory requirements
3.83	contingency plans should be required
3.9	risk-benefit analysis should include all components of the concept
4.2	some discussion on community acceptance should occur
4.21	is discussion on race appropriate?

## SECTION

## COMMENT

4.22

is discussion on income levels appropriate?

4.25

the discussion should include the ownership or designation of the land; for example distinction should be made between privately owned land versus crown land

particular land designations within the study area should be identified; for example park, ecological reserve, provincial wildlife management area etc.

factors listed in the definition of "valued area" should include "recreational"

5.24

is consideration of compensation for health effects appropriate?

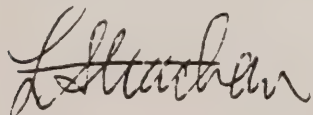
how do you "calculate" compensation for a variety of potential effects of different degree of severity?

should any health effects be allowed?

6. this is a very important section of the Guidelines and should receive more prominence rather than be buried at the end of the document; a more detailed discussion on alternatives and the reasons for the selected alternative for irretrievable burial should take place early in the Guidelines

We appreciate the opportunity to comment on the Draft EIS Guidelines and I would appreciate being kept informed of your progress on this very important matter.

Yours truly,

A handwritten signature in cursive script, appearing to read "L. Strachan".

Larry Strachan, P. Eng.,  
Director, Environmental Approvals  
Telephone: 204-945-7071  
Fax: 204-945-5229













Environment Canada  
Conservation and Protection

Environnement Canada  
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Your file    Votre référence

(96)

Our file    Notre référence

4140-2-11

September 10, 1991

Mr. G. Riverin  
Federal Environmental Assessment Review Office  
13th Floor, Fontaine Building  
200 Sacre-Coeur Blvd  
Hull, Quebec  
K1A 0H3

Dear Mr. Riverin:

Environment Canada has reviewed the draft Environmental Impact Statement Guidelines issued by the Panel for the Nuclear Fuel Waste Management and Disposal Concept. Our response (attached) is submitted to the Panel for their consideration. Should there be any questions regarding clarification of our comments, please contact me.

Sincerely,

D.J. Pascoe  
Manager,  
Nuclear Program  
Conservation & Protection



**GUIDELINES FOR THE PREPARATION  
OF AN ENVIRONMENTAL IMPACT STATEMENT  
FOR THE  
NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT**

**COMMENTS FROM ENVIRONMENT CANADA**

**September 1991**





## INTRODUCTION

Environment Canada believes that the draft Environmental Impact Statement (EIS) Guidelines prepared by the Panel include or mention all principal issues that should be addressed by the proponent in the Environmental Impact Statement. We are pleased to see that so many of the issues raised by Environment Canada, and other intervenors, at the scoping meetings have been incorporated into the draft Guidelines.

The following are some general and specific comments that we hope the Panel will find useful in supplementing or refining some of the details in areas where we think the draft could be improved in its clarity or completeness.

## GENERAL COMMENTS

1. The draft Guidelines are less detailed and strikingly much less quantitative in tone than what is considered sufficient to adequately evaluate the Concept. Environment Canada believes that the EIS should present detailed calculations using well-defined analyses and models, based upon the nature of the process involved, as well as on the specific parameters (measured values and their ranges wherever applicable and available) with fully documented assumptions and rationales for their application in these analyses. It is essential that the Panel states in the clearest possible manner the degree to which it expects the Concept to be evaluated by quantitative analysis and predictive assessment. At present, the requirements for both quantitative analysis and predictive assessment are not explicit in the draft Guidelines.

Section 3.1 provides an example of the lack of specification of quantitative results. The second sentence of that section requires AECL to "identify all means through which nuclear fuel waste may ... impact on these environments". We suggest that the wording be changed to "should identify and quantify the most probable (and most significant) means ...".

The current Guidelines indicate little linkage between the requirements for performance assessment in Section 3.5 and the site characterization discussions of section 3.6. At the very least, the modelling sections (3.514, 3.522, 3.532 and 3.544) should require calculations and sensitivity analysis, not just "discussion" of methodology and assumptions.

2. There is a real unevenness in the presentation of some of the Guidelines arising from the failure of the Panel to be specific about the processes that they wish to see discussed. Thus, on page 14, the very particular and important issue of "channelization of groundwater flow within individual fracture zones" is mentioned, however, on the opposite page, none of the pertinent, general technical terms (e.g. sorption, hydraulic conductivity, porosity, etc.) even merits a mention. This oversight should be corrected in order to prevent it being reproduced in the EIS.

3. Environment Canada is pleased that the Panel has placed considerable emphasis on the impact of social and cultural issues. Recognition should be given to the fact that approaches to reviewing technical issues, and in particular nuclear issues, differ significantly among various parts of Canadian society. Public involvement, education and communications is so important and fundamental to the success of this project that it warrants greater emphasis in the EIS. Accordingly the Panel should specifically request that AECL recognise these differences and present all aspects of the EIS in a form that can be understood by all members of Canadian society. This may require some innovative communication approaches (e.g. videos) and educational programs to be used by the proponent. AECL should document these and any other communications programs they have undertaken, along with comments on their success as part of the EIS.

There is a need for a full, complete and open plan for addressing, learning about, and communicating the social and cultural consensus and impacts, and for explaining the technical and scientific information and issues in non-scientific terms, especially to special interest groups.

This aspect is particularly important when considering communications with aboriginal peoples. The summary document should be translated into the working language of the aboriginal groups, and a commitment should be made by AECL to make special efforts in communicating their findings in person when requested by aboriginal communities and other special interest groups.

4. It is noted that the Guidelines call for the EIS to contain a summary document that should be easily understood by a layperson. This summary document should provide an overview of the contents of the EIS documents. The Guidelines are comprehensive but may result in a somewhat general and fragmented EIS summary. The proponent should be instructed to ensure that the EIS summary will be comprehensive and specific. Given the fact that the EIS will be long, complex and probably involve several seemingly separate volumes, it is crucial that the summary be able to clarify the linkages among the different components of the Concept, and integrate the various impacts posed by those components.

5. The Guidelines use a number of terms which should be defined for absolute clarity. A process of this nature requires unambiguous, clear and concise meanings for all terms. It is recommended that a glossary of terms and definitions be included with the Guidelines. Specific terms that are candidates for definition in the glossary are



identified throughout this document.

In particular, the term "environmental" used throughout the Guidelines needs definition. Environment Canada requests that the definition clarify whether, and in what situations, the term refers to "natural environment" versus a broader, more generic definition.

6. The introductory section raises the point whether issues not identified in the Guidelines are excluded from the EIS and from consideration of the Panel. AECL should not be precluded from putting information into the EIS that they believe to be a critical element of the Concept, or necessary for a full understanding of part or all of the Concept. The EIS Guidelines should encourage AECL to include this type of information.
7. The Guidelines call for current risks to the health of human or natural environments to be discussed. We believe that the discussion should be more explicit. What is required is a full assessment of risks including a discussion of both individual and societal risks. The risks to individuals should be presented together with a discussion of risks to society at large. For each system failure type, the assessment of risk should indicate not only the statistical risk to an individual but also whether communities, in part or whole, will experience a change in risk. It should also be recognised that reference to individual risk also includes risk to societies or groups of people or animals. The "risk to the health of the natural environment" should discuss short and long term risks of major ecosystem change, likely observable or incipient effects in major plant or animal communities, and a review of the present knowledge about how radioactivity can have a synergistic effect on temperate or boreal ecosystems progressively stressed "unnaturally" by toxics, climate change, etc.
8. "Radiation" is used throughout the Guidelines. It should be made clear, perhaps in the suggested glossary, that this is ionising radiation, and does not include other forms (electromagnetic, thermal, etc.)
9. The EIS requires that the issues of flexibility in the AECL Concept be addressed. Specifically, it calls for an examination of the Concept's ability to accommodate changes in technology, host rock preference, environmental hazards or risks and social priorities or values. The Guidelines are reasonable in anticipating a change in social priorities or



values, but the Guidelines do not suggest a process for establishing social priorities or values as part of the EIS. The Guidelines should instruct AECL to specify how they intend to track all changes (technical and non-technical) to ensure the Concept evolves with future norms. The proponent should also be required to specify the method for identifying social priorities/values in response to change.

10. Environment Canada suggested in its submission to the Panel at the scoping meetings that AECL be requested to provide in the EIS a summary of all work either planned or in progress for which results would not be available until after the hearings, and also that AECL present annual assessment briefings for new R&D work. We restate this suggestion as a means of ensuring that all planned research and progress relating to the development of the Concept is taken into account when evaluating the Concept's potential for success. We also feel that it will give the Panel hearings more confidence and integrity if it is openly acknowledged in advance that all the answers are not in, and that research and refinement will continue.

## SPECIFIC COMMENTS

### Introduction, Page 2:

1. The first sentence of the second paragraph should request that the EIS describe all components of the proposed AECL Concept in sufficient detail to provide the rationale for the Concept, its necessity now or in the future, and an understanding of why it was chosen from among a number of other possible concepts.

### Section 2, Page 3:

1. The proponent should be required to present as part of "the problem" a description of the Regulatory rules (R104 etc.) which clearly favour an out-of-sight-out-of-mind disposal concept. These rules leave little or no room for the Long Term Management Approach. AECL should be asked to comment as to whether the flexibility of the Concept, and therefore AECL's ability to put forth the preferred option, is being limited by any regulations.

### Section 2.2, Page 4:

1. In the third paragraph the Guidelines call for a review of trends and characteristics of public concerns related to nuclear fuel waste management. The proponent(s) should be required to specify the method for establishing existing concerns and determining factors driving public preferences for alternative waste management methods.
2. Public concern and attitudes should be clarified as Canadian, global, North American etc.

### Section 2.4, Page 5:

1. It is quite possible that Canada's high level nuclear fuel waste will represent one of the world's largest sources of plutonium. Given that a limiting factor in the spread of nuclear weapons is the unavailability of fissile materials such as plutonium, a relatively concentrated source of this man-made element could represent a tempting target to a terrorist organization, even if only a small fraction of the mass is  $^{239}\text{Pu}$ . The diversion of weapons grade material from a supposedly secure U.S. facility to a foreign power has already been documented, therefore this is not an outlandish

proposition. We recommend that terrorist acts be considered as a threat to the security of the nuclear fuel waste. (See comment under Section 3.8.)

#### Section 3, Page 5:

1. The Guidelines specify that material availability is to be addressed only with respect to the storage containers (page 9, Section 3.512) and transportation containers (page 24, Section 3.82). More comprehensive consideration of this issue (buffer, sealants) should be specified in the Guidelines.

#### Section 3.1, Page 6:

1. Reference to "current nuclear fuel waste management practices" in the last sentence is unclear. We suggest the sentence be revised to "...risk incurred by an extension of current nuclear fuel waste management practices (i.e. indefinite long term storage) versus that which would be incurred by the Concept."

#### Section 3.33, Page 7:

1. In assessing a multiple engineered barrier concept, such as that proposed by AECL, it is important for the proponent to clearly state (as one of the "assumptions used") what credit is being claimed for each barrier. For example, in AECL's current Concept, no credit is claimed for the thin-walled titanium container although it will clearly last a significant time. The credits being claimed, or not being claimed, for various barriers or materials must be clearly stated and justified.
2. The following point should be added to the list of items the EIS should examine:  
  
"identification of areas where it is possible that future research results could cause a re-evaluation of the Concept".

#### Section 3.4, Page 8:

1. In the discussion of alternatives to irretrievable burial, Section 3.4 mentions consideration of "implications of a number of repository sites instead of one central facility". This reference to investigating multiple sites should be expanded for clarity to say:



"implications of a number of repository sites instead of one central facility, including the impact on transportation risks, social and economic impact and the effect of economies of scale".

Section 3.511, Page 9:

The first point within the second paragraph requests that the EIS must identify the "most critical" radionuclides. The Guidelines should also request that "most critical" be considered with specific reference to health risk, environmental risk and waste disposal concerns. It should be recognised, and addressed by AECL, that the "most critical" radionuclides will change over the years due to decay processes, and therefore time will play an important role in researching and determining the impacts of the Concept (i.e. transportation after twenty years of storage will present problems different from those resulting from transportation after 100 years of storage). AECL should be asked to indicate "how most critical is defined during pre and post closure phases".

2. All the important processes seem to have been included in this section, however it is not evident that the word "consider" used in the Guidelines means "quantify". AECL should be required to not only "describe the methods", but to "discuss the quantitative relevance of realistic methods".

Section 3.512, Page 9:

1. The Guidelines state that the EIS must describe the predicted performance of the container system, which entails a definition of container failure, a description of possible models, a discussion of mechanisms of weakening and a discussion of the environment in which the waste will be emplaced. Nowhere is it said that AECL must provide a defensible probability distribution on container breach, a calculation that is certainly a requirement of a complete EIS. This is one of several examples of the Guidelines' lack of clarity in saying what is expected of AECL.

Section 3.513, Pages 11-13:

1. The final item on page 11 should request a more specific, quantitative description of the effect of the damaged rock zone on the hydraulic and strength properties of the vault.
2. At the top of page 12, it is recommended that the wording be changed from "a description and evaluation of the expected



post-construction stress conditions in the overall vault design" to "a description and evaluation of the consequences of the expected post-construction stress conditions in the overall vault design, and the justification for the input parameters and the evaluation procedures utilized." That is, we wish to know the basis on which AECL concludes that matters are or are not satisfactory.

3. Environment Canada expects that, in their description of the vault sealing program, AECL will discuss the effects of coupled processes involving heat, salinity and radiolysis on the integrity of all sealing materials (i.e. buffer, backfill and grouts). The present discussion of the Vault system contained in the Guidelines pays little attention to the very important matter of the reaction of any escaped radionuclides with the buffer and backfill at elevated temperatures and salinities. Environment Canada expects this issue to be discussed in a quantitative manner in the EIS.
4. Vault sealing materials are defined to consist of buffer, backfill and grout (Page 12). The buffer materials (likely to consist of smectitic clays) are to play a key role in the retardation of radionuclide migration. Thus, in view of the significance of the buffer materials in a multiple-barrier system repository, the proponent should be asked to describe the characteristics, and permissible variations in specifications or performance, of the buffer materials in much more detail than presently outlined in Section 3.513.

**Section 3.514, Page 13:**

1. It is suggested that the second item in this section be broadened to read:  
  

"assumptions made concerning processes and parameters, and the justification for, and consequences of, making them".

**Section 3.521, Page 14:**

1. It would be appropriate to include in this section a directive to AECL that they summarize the state of knowledge about groundwater flow systems on the Shield.
2. A key idea is missing throughout section 3.521. After the first sentence it should be stated that site-specific demonstrations are required to provide rigor to AECL's Concept assessment.

3. The list that follows the introduction to section 3.521 does require some quantitative analysis (e.g. residence times), however, the list is predominantly narrative in nature not quantitative.
4. Environment Canada recommends that "the potential for induced seismic or microseismic events (and the effects of such events) due to mechanical or thermal perturbations resulting from repository construction and operation" be included in this section.
5. A more detailed guideline to AECL on the quantitative assessment of sorption, solubility and the colloidal aspects of radionuclide transport in the presence of fracture infill minerals is in order. "The discussion ...[of]... relevant ... chemical ... and biochemical processes in the rock mass that may impede or enhance the transport of radionuclides along critical pathways" suggests such a narrative tone that AECL might conclude that quantitative analysis need not be the basis for their presentation.

**Section 3.522, Page 15:**

1. Most obviously missing from section 3.522 is inclusion of the methodology for estimating the retardation of radionuclides during solute transport within the host rock.

**Section 3.531, Page 16:**

1. The first sentence should be modified to read:  
  
"... and other contaminants and the consequent exposure of biological systems to them."
2. We suggest that the following statement be added to the list of properties to be discussed in the EIS:  
  
"a description of the typical ecosystem types (e.g. wetlands, lakes) that are expected to occur in the general area of plutonic rock, and the processes by which they may become receptors for radionuclide releases, and be affected by the construction and pre-closure phases".
3. The reference to fluid movement in the second statement is unclear. Is this referring to dilution and resultant exposure? The Guidelines should state whether "fluid" in this context includes air.

**Section 3.54, Page 17:**

1. The lack of clarity in specifying the degree to which AECL must demonstrate their Concept is illustrated by the Guidelines on page 17. It is noted that the assessment procedures should be "discussed" but it is not stated that the procedure has to be implemented. It is by inference (from Section 3.1) that we deduce the Panel wants a demonstration of the longterm performance assessment of the Concept. The Guidelines should make it clear what demonstration is required.

**Section 3.541, Page 18:**

1. The validation requirements for models to be used in performance assessment should include a statement that AECL must attempt a demonstration of the validation of their models, rather than to simply explain their procedure. For example, it is critical that AECL document how it will validate the SYVAC code (and calibrate it). It is unclear how AECL will be able to defend SYVAC predictions without such calibration and validation.

**Section 3.542, Pages 18-19:**

1. It is essential that the EIS demonstrate that the models selected by AECL are robust; that is, they are capable of simulating conditions over wide ranges of physical and chemical variables. AECL must state the range(s) of validity and demonstrate the validity of the models over the range(s).

**Section 3.546, Page 20:**

1. Is this section necessary or can it be incorporated into a general discussion on modelling/simulation?
2. It seems unnecessarily prescriptive to specify a finite element model when some other type of numerical scheme may be equally suitable.

**Section 3.6, Page 20:**

1. The second paragraph, second sentence should be modified to read:

"... should indicate procedures for selecting and ranking sites ..."



**Section 3.61, Page 21:**

1. The third point is too general to provide any guidance concerning how the proponent should address uncertainty. The following wording is suggested:

"a discussion of the consequences of the uncertainties involved in the description of candidate sites ..."

**Section 3.74, Page 23:**

1. It is recommended that this section on emergency planning be amended to direct AECL to prepare contingency plans to recover the wastes from the repository in either pre-closure or post-closure times in the event that this becomes desirable.

**Section 3.8, Pages 24 - 26:**

1. There should be a description of the present Canadian transportation system for used fuel or other nuclear waste and a comparison with the proposed system. A look at known risk, experience, impacts of the present system, institutional considerations (essentially a "lessons learned" section) would be useful.
2. The structure of the description of the plan for the transportation system should be similar to the description of the present system. However, this description should also include a review of alternatives to some of the elements, such as alternative modal mixes, routes, and operational procedures. Given that this is done, there would be a need for a discussion of each system modification and the probable risks and environmental impacts.
3. A serious omission from this section is specific consideration of terrorist activity and other security threats against the casks. While this may be a low-probability event, the potential consequences of even a moderately successful attack by terrorists are severe enough to be addressed in terms of environmental impact and public perception. (See comment under Section 2.4.)
4. Specific mention should be made in this section of quality assurance mechanisms in the development of casks, which would serve to reduce risk or impact. Within the QA area, the consequences of human error in cask fabrication, handling and transportation need to be taken into account.



**Section 3.9, Page 27:**

1. The requirements specified in the draft Guidelines are insufficient to provide a meaningful cost and economic analysis.

It is recognised that the Concept is generic rather than being site specific, and as such, detailed cost estimates are difficult, and could in fact vary by orders of magnitude depending upon the sites being considered. However, the proponents should be required to show how all the costs of implementing the Concept will be estimated, assigned and distributed. This should include soft costs, and the costs incurred by all parties (including the environment itself), not just the proponents. The philosophy behind the costing procedures, and for assigning responsibility for the costs (including the costs to future generations) must be discussed.

Since the credibility of forecast cost data and funding arrangements will be of interest to many, the procedures for determining costs should be supported by information concerning underlying assumptions, estimates, sources of data and forecasting methods. The sensitivity of the forecast total cost to major assumptions and estimates, and to key elements of the Concept should be presented.

**Section 4, Page 27:**

1. The term "baseline environment" should be defined (in the suggested glossary). Are these the data that distinguish the environment at the reference site?

**Section 4.1, Page 28:**

1. The sixth point in this Section ("food chains and radiation pathway mechanisms") is unclear and should be revised to read:

- "- food chain transport mechanisms of radionuclides and other contaminants.
- mechanisms by which radiation and other contaminants effect the biota".

2. The last point should be modified to:

"... and sensitive species can be determined.  
Definitions and rationales for significance levels used to describe changes are to be provided."

**Section 4.26, Page 30:**

The proponent should include the following local/regional indicator in the list:

- protective services (to cover law enforcement and fire protection).

**Section 5.1, Page 31:**

1. The first sentence in this Section should be enlarged to:  
"... on the natural environment, and to manage these potential impacts."
2. The first paragraph should make it explicit that impacts must include not just radiological ones but also impact from construction and pre-closure operation of the facility.
3. The sixth point in this Section ("food chains and radiation pathway mechanisms") is unclear and should be revised to read:
  - "- food chain transport mechanisms of radionuclides and other contaminants.
  - mechanisms by which radiation and other contaminants effect the biota".
4. The last point should be modified to:  
"... and sensitive species can be determined. Definitions and rationales for significance levels used to describe changes are to be provided."
5. The list of issues should include the:
  - "- relationship between effects on natural environment and human environment; and
  - use of reference sites to predict and determine impacts".

**Section 5.24, Page 34:**

1. Although the Concept being evaluated is generic not site-specific, there must be some method for measuring the economic impact of the Concept. It is recommended that the following phrases be added to this Section:

"The proponent should discuss the supply of capital and the debt-servicing ability in the economy. The indicator(s) and criteria relevant to each of these areas should be identified and discussed by the proponents.

The study strategy should discuss the impacts of the Concept on the economy and income level of the province and country. This should include an evaluation of the following:

- sectors of employment and skill base;
- sectoral output levels and purchases;
- income levels; and
- employment/unemployment trends."

**Section 5.26, Page 35:**

1. Consistent with the addition to Section 4.26, this Section should include an evaluation of the impacts to:
  - protective services (to cover law enforcement and fire protection).











September 6, 1991

COSUN review of guideline for the preparation of an environmental impact statement: Environmental Assessment Panel Reviewing The Nuclear Fuel Waste Management and Disposal Concept

1. The draft guideline and the assessment of a concept:

A review of the draft guideline fully supports COSUN's scoping submission position that the AECL proposal for an environmental assessment of a "concept" assessment was incomplete and should not have been accepted by the Panel.

The Panel has produced a guideline based entirely on a theoretical, conceptual foundation. The questions raised in the guideline can only elicit theoretical, conceptual responses from the proponent. There is no proposed geographical location or locations at which site specific environmental effects may be assessed.

Even in situations such as oil exploration, and construction of oil pipelines in the North, alternative specific environments have been identified. Such projects were not concepts, but rather actual proposals for interventions into specific environments, using existing technologies. This is not true in the case of the AECL concept, which is a proposal lacking an implementation component.

The very language used in this draft guideline reflects the absurdity of an environmental assessment of a concept assessment. It is a "smoke and mirrors" document replete with abstractions and vague and circumlocutional statements and questions stated in awkward terminology.

For example, under the heading "Impacts on the Natural Environment, the following appears:

"The study strategy should use an ecological scoping process to incorporate a conceptual outline of the project within an ecological setting, and should evaluate the impacts of the Concept on the ecological habitats structure and function of the receiving environment. This conceptualization must explore the



linkages between the Concept and ecosystem components through cause and effect relationships....

This kind of terminology is typical of the guideline and is a natural consequence of the Panel's attempt to assess an abstraction in the absence of an environment.

COSUN has no doubt that it is exactly the kind of writing that AECL will welcome, since it can easily provide answers in language of equal or even greater "bafflegab."

COSUN maintains that there can be no "environmental consequences" of an idea, concept, or theory, per se, (except, perhaps the paper and ink materials used in the study). The environmental consequences can only be measured when and if an actual plan exists for the implementation of that idea, concept or theory in a real place in the real world.

In effect, what the Panel has been asked to review is a decision-making function rather than the subject of a decision.

COSUN contends that serious consequences will result if the Panel proceeds with its review of this non-proposal: AECL and the public are being asked to comment on and provide evidence of potential adverse environmental effects which are patently unassessable, thus creating a significant waste of time and money. Future decision-makers and intervenors faced with site-specific nuclear fuel waste proposals will be influenced, if not bound, by the results of the present Panel's findings, which will be based on the assessment of non-existent environmental effects. The results of this review will have a significant downstream impact on decisions to build new nuclear reactors or otherwise make use of radioactive substances that will require disposal.

COSUN considers that since there is no environment to assess, the Panel was not properly constituted. A concept is not properly a "proposal" as defined in the Guideline Order.

## 2. Other Concerns

Following are other concerns COSUN has with this draft guideline:

A. The draft guideline is too narrowly focused

In the Terms of Reference, the Minister directed the Panel to disregard the role of nuclear energy within federal and provincial energy policies, including the construction, operation and safety of new or existing nuclear power plants.

The terms of reference, do not, however, restrict the Panel from considering the facilitation and encouragement of nuclear waste production. In fact, under Section 25 of the Guidelines Order, the Panel is required to "examine the social, economic and environmental implications of a possible nuclear fuel waste management facility." The terms of reference only require the Panel to disregard the role of nuclear energy within federal and provincial energy policies. The restriction goes no further than that.

The Panel appears to have interpreted the restrictions in the Terms of Reference to mean that it cannot consider the possible encouragement of nuclear waste production. This mistaken interpretation does not comply with the requirements of Section 25 for a public review.

Furthermore, this interpretation creates an absurd situation wherein non-specified and unlimited quantities of nuclear wastes could be produced for a non-existent, presumably finite, disposal site.

AECL's concept, which purports to be a solution to the disposition of nuclear waste, if implemented, would encourage the production of nuclear waste. This self-evident proposition has been recognized by public jurisdictions (e.g., California, British Columbia) that have banned the production of nuclear waste until a solution has been found.

It is quite impossible to conduct an environmental assessment of AECL's proposed solution to the nuclear waste problem without a physical site and, most decidedly, without considering the basic issues involved in the production of nuclear waste.

B. The Draft guideline disregards specific issues raised by COSUN

Not only is the draft guideline inherently invalid, it did not even address the specific regulatory and institutional issues identified by COSUN.

These issues formed the basis of the COSUN intervenor funding proposal for the scoping segment of this process and constituted the major portion of COSUN's submission to the Panel, in Montreal, on November 16, 1990.

Most of the points raised by COSUN fall well within the narrow terms of reference for the Panel, as they do address social issues (in the broadest sense) which relate to AECL's concept assessment. The regulatory and institutional framework surrounding the AECL concept contain issues which COSUN considers essential to a full public understanding of the Canadian nuclear waste management program.

Even the EARP Funding Administration Committee clearly considered that AECL should address these types of issues in its EIS. The Committee told COSUN, in its September 12, 1990 letter, that COSUN's "proposal may be more appropriate for the next stage of the review, depending on how this issue is addressed by AECL in their Environmental Impact Statement."

The obvious question is, how can AECL consider the issues raised by COSUN in its EIS, if the Panel's guideline to AECL does not specifically address these same issues ?

For the convenience of the Panel, following, in summary form, are the key issues raised by COSUN which are not specifically addressed in the draft guidelines:

- . In the absence of any applicable Canadian laws which clearly provide for the "disposal" of high-level radioactive waste, under what authority did AECL proceed with its "concept assessment?"

- . Why did AECL proceed with its "concept assessment" knowing that the Government of Canada had already rejected the concept of underground nuclear burial when it successfully engaged in intense diplomatic efforts to prevent the U.S. Government from characterizing and conducting research in a number of states in Cambrian Shield rock near the Canadian border?

- . As discussed earlier in these comments, why did AECL provide an incomplete proposal, in the light of FEARO guidelines and



official documentation of the EARP process, which requires a Panel to consider site-specific environments, e.g., to "hear from people who could be affected by the proposal, particularly those who live near the proposed site," and to prepare a report which includes "the characteristics of the proposed site and impacted areas"?

. Why did AECL ignore a body of scientific opinion which holds that in situ research should be performed only at sites deemed potentially usable for full-scale, high level waste repositories?

. Is not AECL in a conflict of interest (marketing nuclear technology on the one hand and trying to get rid of nuclear waste on the other hand)?

. How does AECL square its perennial prejudgements of success of its concept assessment with the rigorous requirements of scientific method, which demand an atmosphere of experimentation designed to try to disprove, rather than to "verify" an hypothesis?

. Why has AECL not responded to the overwhelming and increasing public disapproval of its concept, (as reflected in over ten years of its own opinion surveys) by seeking more publicly acceptable alternatives for the long term management of high level radioactive waste?

. Why has AECL not produced scientific criteria for the best possible underground radioactive waste repository site? In this regard, COSUN rejects the vague and weak notion of an "ideal site" expressed in this draft guidelines, particularly in light of AECL officials stating many times that there are many possible sites in the Canadian Shield and that communities will line up and bid to host such a facility.

. COSUN notes that the guideline does contain questions relating to possible problems or negative consequences of this concept. But the Panel did not ask for the most critical data along these lines. To repeat the question in COSUN's submission, "Should not this Panel require that AECL develop a complete inventory of each and every un-answered and partially-answered scientific question raised in all the scientific studies conducted for this concept?"

In conclusion, COSUN considers that the draft guidelines, and, indeed, this entire environmental assessment is invalid, and



recommends that the Panel request the Federal Environmental Assessment Review Office to instruct AECL either to withdraw its proposal, or to present another proposal which is complete, i.e., includes the selection of an actual physical site for a high-level radioactive waste repository. Furthermore, any new proposal must include consideration of the issues surrounding the production of high-level radioactive waste. Then, and only then, can a valid environmental assessment be undertaken.

*Walter L. Robbins*

Walter L. Robbins  
Member, Steering Committee  
COSUN





ACNS  
CCSN

Advisory Committee on Nuclear Safety  
Comité consultatif de la sûreté nucléaire

Reply to/Répondre à:

13 August, 1991

File/Référence: ACNS: 65-05-00

Mr. Blair Seaborn, Chairman  
Nuclear Fuel Waste Management Panel  
Federal Environmental Assessment Review Office  
13th Floor - Fontaine Building  
200 Sacré-Coeur Boulevard  
Hull, Québec  
K1A 0H3

Dear Mr. Seaborn:

At its meeting of August 12, 1991, the Atomic Energy Control Board's Advisory Committee on Nuclear Safety (ACNS) discussed the draft report of FEARO's Nuclear Fuel Waste Management Panel entitled "Guidelines for the Preparation of an Environmental Impact Statement", dated June 1991.

While there are several matters of interest to the ACNS in the document, the Committee wishes to restrict its comments to two major points, namely the delays associated with the assessment process for the disposal of nuclear fuel wastes, and the selection of the concept for that disposal.

The ACNS is concerned that public hearings are now not expected until 1994, whereas initially (1989) those hearings were expected in 1992. The ACNS believes that delays in the EARP are endangering the viability of a waste disposal program vital to the Canadian overall energy policy. The situation at the present time is serious enough to justify whatever action could be taken to avoid future delays.

The second concern of the ACNS (also related to the first) is that consideration of only one concept has been scheduled so far. The Panel's terms of reference direct it to review a broad range of nuclear fuel waste management issues, not just the concept being developed by AECL. Delaying examination of the alternatives until after the EIS hearings will only further postpone the final decision. As a consequence, the ACNS urges the Nuclear Fuel Waste Management Panel to revise its schedule so that the parallel activities envisaged in the Panel's Terms of Reference can be undertaken while awaiting the EIS hearings.



It seems appropriate that the present generation, which has derived most tangible benefit from the products of current nuclear reactors, should have the responsibility for developing an acceptable means for the safe disposal of the resulting wastes. Any significant delay in completing this task is likely to reinforce the public perception that no satisfactory solution will be found and that therefore the use of nuclear energy should be phased out, - its loss to the Canadian energy program notwithstanding.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'A. Pearson', written in a cursive style.

A. Pearson  
Vice-Chairman

c.c. Dr. R.J.A. Lévesque  
ACNS Members  
R.J. Atchison





(121)

Lawrence E. Leonoff, General Counsel and Secretary / Telephone (416) 592-2755

September 6, 1991

Mr. Blair Seaborn, Chairman  
Nuclear Fuel Waste Management Panel  
FEARO  
13th Floor, Fontaine Building  
200 Sacre-Coeur Blvd.  
Hull, Quebec  
K1A 0H3

Dear Mr. Seaborn:

**Re: Public Review of Nuclear Fuel Waste Management and Disposal Concept**

We have reviewed the draft guidelines which, when finalized, will be forwarded to Atomic Energy of Canada Limited (AECL), the proponent, for the preparation of the Environmental Impact Statement on the Canadian Nuclear Fuel Waste Management Concept.

In our opinion, certain parts of the guidelines go beyond the scope of this Panel's mandate which is to "review the acceptability of AECL's concept of geological disposal of nuclear fuel wastes in Canada...". This mandate was specifically outlined in the terms of reference issued by the Environment Minister in 1988 wherein it was also specified that "...the construction, operation and safety of new or existing nuclear power plants ... are outside the Panel's mandate and should not be addressed during the review." We therefore submit that the guidelines be revised to reflect the 1988 terms of reference and the Panel's mandate.

Specific revisions to the guidelines include:

On page 2, first paragraph, it is noted that "Interim storage and transportation of nuclear fuel waste are considered to be part of the Concept." The words interim storage should be removed from this sentence. Interim storage of used nuclear fuel - a well-established technology licensed by the AECB - is part of the operation of existing nuclear power plants and should not be required to undergo review by bodies other than those currently required for licensing and operating purposes.

We request that Section 2.2 and the first sentence of Section 2.3 of the guidelines (pages 3 and 4) be deleted as they specifically relate to questions of operation and safety of existing nuclear power plants and go beyond the scope of this concept review.



-2-

We do appreciate that during the public review of the deep geologic disposal of nuclear fuel waste, the Panel may find it desirable to have, as background material, comprehensive information on current storage practices at nuclear generating stations. If you so request, Ontario Hydro is prepared to provide such information.

In the same vein, we submit that while the used fuel transportation assessment will form part of this review because it is contextual to the disposal program, the licensed technology of used fuel transportation is excluded. However, it is our understanding that AECL is intending to provide generic information pertaining to environmental effects relating to alternative modes of transportation of the Panel's consideration.

We look forward to a favourable response regarding our concerns. Should any additional elaboration be needed kindly contact Peter Stevens-Guille at (416) 592-6024.

Yours truly,



L.E. Leonoff







R-2756  
ES&WM-91-228  
1991 September 13

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**BY FACSIMILE**

Mr. Blair Seaborn, Chairman  
Nuclear Fuel Waste Management Panel  
Federal Environmental Assessment Review Office  
13th Floor Fontaine Building  
200 Sacre-Coeur Blvd.  
HULL, Quebec  
K1A 0H3

Dear Mr. Seaborn:

I write on behalf of AECL to comment on the draft Guidelines for the EIS on the Nuclear Fuel Waste Management and Disposal Concept. On behalf of the staff working on the Nuclear Fuel Waste Management Program, may I first express our appreciation for the effort made by the Panel in drafting the Guidelines for the EIS. Our comments, contained in the attachment to this letter, have been generated after a careful analysis of the Guidelines by members of our staff involved in the preparation of the EIS. They are intended to complement and enhance the thoughts embodied in the draft Guidelines, and, as appropriate, clarify certain aspects of the Disposal Concept.

In the attachment, we provide a definition of the Disposal Concept that we believe is consistent with AECL's mandate and which the Panel was asked to evaluate under its Terms of Reference. Should the Panel disagree with our understanding, it is crucial that we are advised to this effect at the earliest possible date.

AECL believes that the Environmental Impact Statement should only address the Disposal Concept. AECL is prepared, however, to assist the Panel with issues that are outside of the Disposal Concept yet within the Panel's Terms of Reference by providing it with available information not included in the EIS, or by directing the Panel to other sources of such information.

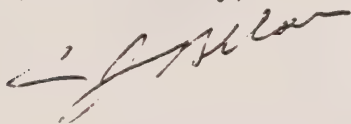
In our view, it is very important to distinguish between the concept that is now under review, and a specific project that may be implemented in the future for the disposal of nuclear fuel waste. Such a project would be subject to a separate review should a decision be taken to implement disposal.



To conclude, I reassure you of AECL's intention to cooperate with, and assist the Panel in their task of assessing the concept for the disposal of nuclear fuel waste. We look forward to producing an EIS that will fully and clearly explain the Disposal Concept to the Panel and to the general public.

I hope the Panel finds our comments to be useful and constructive. Please contact me if any clarifications are required.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'C.J. Allan', written in a cursive style.

C.J. Allan, Vice-President  
Environmental Sciences & Waste Management

c.c. S. Toller

AECL RESPONSE TO DRAFT GUIDELINES  
FOR PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT  
FOR THE ENVIRONMENTAL ASSESSMENT PANEL  
REVIEWING THE NUCLEAR FUEL WASTE DISPOSAL CONCEPT

1. INTRODUCTION

The Canadian Nuclear Fuel Waste Management Program was launched by the governments of Canada and Ontario in 1978. AECL was given the mandate to research, develop and evaluate the technology for disposal of nuclear fuel waste in intrusive igneous rock of the Canadian shield and to prepare an assessment of the Disposal Concept for scientific, government and public review. In 1981 the two governments also announced that selection of a disposal site and responsibility for site selection and operation would not proceed until the concept had been reviewed and assessed. Thus the concept developed by AECL is generic rather than site specific.

In 1988 the Minister of Energy, Mines and Resources asked the Minister of the Environment to establish an Environmental Assessment Panel to review the concept. In 1989 a Panel was established to determine "whether AECL's concept for geological disposal of nuclear fuel waste is safe and acceptable or should be modified". The Panel was also asked to address "the future steps to be taken in the management of nuclear fuel wastes in Canada". The Environmental Assessment Panel that was subsequently established has now issued Guidelines to AECL for preparation of an Environmental Impact Statement. This submission summarizes AECL's comments on these draft Guidelines. The submission is in two parts: the first part deals with general issues while the second part presents detailed comments referenced to specific statements in the draft Guidelines.

In presenting these comments AECL would like to note the unusual nature of the environmental assessment that the Panel has been asked to undertake. A concept, rather than a proposal to implement a specific project at a specific site, is being submitted for review. AECL believes that its Environmental Impact Statement should be restricted to its Disposal Concept and our comments on the draft Guidelines have been written from this perspective. AECL acknowledges, however, that the Panel may require information on issues outside the Disposal Concept but within the Panel's Terms of Reference. AECL is prepared to assist the Panel in obtaining such information by providing the Panel with available information not included in the EIS or by directing the Panel to other sources of such information.

## 2. OVERVIEW COMMENTS

### 2.1 AECL'S DISPOSAL CONCEPT

The concept AECL is proposing for the disposal of nuclear fuel waste, the "Disposal Concept", is based on burial of the waste deep in the intrusive igneous (plutonic) rock of the Canadian Shield, in combination with suitable engineered barriers. In the following paragraphs, the use of the term "disposal", the relationship between disposal and retrievability, the scope of the concept, and the purpose of the hypothetical facility design developed for this assessment are discussed.

The term "disposal" is used by AECL as it is used in other countries and as it was defined by the Atomic Energy Control Board in Regulatory Document R-104: "For the long-term management of radioactive wastes, the preferred approach is disposal, a permanent method of management in which there is no intention of retrieval and which, ideally, uses techniques and designs that do not rely for their success on long-term institutional control beyond a reasonable period of time."

Thus, by definition, disposal means there is "no intention of retrieval". This does not imply that the waste would be irretrievable and, indeed, waste disposed of according to the Disposal Concept could be retrieved. The objective is, however, to develop a facility, conceptually at the present stage of development, that will not require that the wastes be retrieved and which does not rely on institutional control for its effectiveness.

The Disposal Concept developed by AECL has been developed in accordance with the mandate given to AECL by the governments of Canada and Ontario in their joint statement of 1978 to

- research, develop, and evaluate the technology for disposal of nuclear fuel waste in intrusive igneous rock of the Canadian Shield.

In presenting its concept to the Panel, AECL believes that it would be inappropriate for AECL to re-evaluate the decision taken by the governments of Canada and Ontario that AECL should focus its program on a particular geological medium, namely intrusive, igneous rock of the Canadian Shield. Thus, the Disposal Concept does not include alternative media for land-based geological disposal, such as salt or shales, nor other media such as seabed or ice sheets.

The Disposal Concept does not include the technologies for storage and transportation of used fuel, technologies that are proven and operational in Canada. However, the environmental and social impacts of large-scale transportation of used fuel from interim storage at a reactor site to a disposal facility are being assessed as part of AECL's program.

The Disposal Concept permits a choice of waste forms, methods, materials, and designs, and if the concept were to be implemented, a disposal facility would be designed specifically for a selected site. Because the governments of Canada and Ontario in their Joint Statement of 1981 stated that no site can be selected before the concept is assessed, reviewed, and accepted, AECL has developed a concept that is generic and not site



specific. To establish the acceptability of the concept, AECL believes it is sufficient to show that:

- the technology exists to site, design, construct, operate, decommission and close a disposal facility in plutonic rock, such that the facility would meet criteria for the protection of human health and the environment,
- a methodology is available to evaluate the performance of a disposal facility in plutonic rock in terms of the criteria for protection of human health and the environment, and
- many potentially suitable sites exist in Canada.

Relevant safety and environmental criteria have been established by the Atomic Energy Control Board (AECB) and international agencies. AECL's research and development program has been directed towards establishing the three points listed above. To help establish the acceptability of the concept, three case studies have been carried out.

- A conceptual design of a hypothetical disposal facility (the reference design) has been developed;
- The short-term impacts of implementing the reference design at a hypothetical site have been assessed; and
- The long-term impacts resulting from locating a hypothetical disposal facility at a hypothetical site having subsurface characteristics based on and consistent with results obtained from an actual field research area have been assessed.

The Disposal Concept can accommodate changes in reference design and therefore the specific reference design used in these case studies need not necessarily be implemented as a part of any possible future waste disposal system.

Since at the current stage of the program there is no specific project, it is not appropriate to propose a specific project structure for the administration, budgeting, and cost control that would be associated with any such future waste disposal system.

## 2.2 TERMINOLOGY FOR AND SCOPE OF THE DISPOSAL CONCEPT

AECL considers the term "irretrievable burial" as used in the draft Guidelines inappropriate to describe the Disposal Concept. The distinguishing features of disposal are that, ideally, there is no requirement for long-term institutional controls to maintain safety and that there is no intention of retrieval. The term "irretrievable", however, implies that retrieval is not possible rather than simply not intended. AECB regulatory policy requires that the waste be retrievable during the preclosure period, and AECL intends to describe measures for retrieval during this period. Retrieval in the post-closure period is not intended and the disposal facility is not designed to facilitate retrieval. Although there is no reason to believe that the waste could not be retrieved, at least for several hundred years following vault operation,



AECL does not intend to describe measures for retrieval after vault closure.

As described previously, the Disposal Concept is burial deep in plutonic rock, consistent with the mandate given AECL by the federal and Ontario governments. The draft Guidelines (see for example Section 3.32 and Section 3.4) appear to treat any type of "irretrievable burial" as the Disposal Concept. AECL respectfully requests that the Guidelines be reworded to reflect the correct definition of the Disposal Concept and to use appropriate terminology for referring to it, such as "disposal in plutonic rock of the Canadian Shield", instead of "irretrievable burial".

### 2.3 ALTERNATIVES TO IRRETRIEVABLE BURIAL

As noted above, AECL was directed by the government of Canada to concentrate its research resources on plutonic rock of the Canadian Shield. AECL has followed this directive and the results of the research activities will form the basis for AECL's assessment of the safety and acceptability of the Disposal Concept.

Thus, AECL's assessment of the Disposal Concept does not depend on comparisons with, or between, "alternative methods of irretrievable burial". Within the context of past decisions, AECL believes it would be inappropriate for AECL to make such comparisons in the EIS.

AECL can provide an overview description of the status and developments in nuclear fuel waste management in other countries to provide appropriate context and perspective for AECL's Disposal Concept. This would include information on their deep geologic disposal programs and the different disposal media being considered. AECL can also provide qualitative descriptions of alternatives to geologic disposal.

### 2.4 CURRENT PRACTICES AND THE NEED FOR THE DISPOSAL CONCEPT

The need for disposal of nuclear fuel waste was established in 1977 by the commission under the chairmanship of Professor Kenneth Hare, which undertook a detailed study of the nature of nuclear wastes, methods of waste management, and alternative disposal methods. The conclusions of the Hare Commission were reaffirmed by the Porter Commission on Electric Power Planning. The need was accepted by the federal and Ontario governments when they established the Nuclear Fuel Waste Management Program and gave AECL its mandate to undertake research and development on the Disposal Concept. It has since been reaffirmed by the federal parliamentary Standing Committee on Environment and Forestry (1988) and by the federal parliamentary Standing Committee on Energy, Mines and Resources (1988). AECL was not asked as part of its mandate to re-evaluate the need for disposal, and AECL respectfully suggests it is not appropriate to re-open the issue during this review. AECL intends, however, to describe the rationale that was the basis for establishing the need for disposal. In this context, it is inappropriate to include in the EIS a comparison of the risk of current practices with the risks of disposal.

Further, the Terms of Reference of the Panel explicitly exclude a review of the operation of new and existing nuclear power plants, and current waste management practices form an integral part of the operation of existing nuclear power plants. AECL respectfully submits, therefore, that it is

inappropriate for the Panel to review the risks of current waste management practices as part of the review of the Disposal Concept.

AECL can, however, provide a general description of current practices as background information to assist the Panel in its deliberations.

### 3. DETAILED COMMENTS

#### 1. Introduction, para. 1, p.2

"Interim storage and transportation of nuclear fuel waste are considered to be part of the Concept. The areas of responsibility of the proponent(s) should be clearly identified."

The AECL Disposal Concept does not include the technologies for storage and transportation of used fuel. This is because storage and transportation are currently existing, operational technologies in Canada. However, the environmental and social impacts of large-scale transportation of used fuel from interim storage at reactor sites to a disposal facility should be assessed as part of the Disposal Concept.

#### 2. Sections 2.2 and 2.3, p.4; Section 3.1, p.6; Section 3.6, p.20; Section 3.62, p.21; Section 4.2, p.28; Section 5.2, p.32; and Section 6, p.36

Definition of the term "Human environment".

The draft EIS Guidelines use the term "human environment" in a number of places. AECL requests guidance as to the meaning of the term, and whether the term is meant to be applied consistently throughout the EIS. AECL also requests the opportunity for further comment once the definition of "human environment" has been established.

#### 3. Section 2.0, para. 1, p.3

"Current methods of nuclear fuel waste management in Canada should be outlined, and the need for long-term waste management should be examined."

AECL could provide an overview of current practices in Canada. However, the "need" for long-term waste management is a decision that was made by the federal and Ontario governments, as set out in the Joint Canada/Ontario Statement, following initial studies commissioned by the governments. The governmental recognition of the "need" for a long-term waste management solution was the reason for the development of AECL's Disposal Concept. This decision should not be re-evaluated by AECL in the context of the review assessing the safety and acceptability of the Disposal Concept.

#### 4. Section 2.2, para. 1, p.3

"The objectives of the various waste management programs should be outlined, as well as the ability of current programs to meet their objectives."

This section of the draft EIS Guidelines also addresses the issue of "need" for a long term waste management solution. The same comments set out in Point 3, above, are applicable here.



5. Section 2.2, para. 2, p.4

"Past performance of the nuclear industry in managing nuclear fuel waste should be documented. Containment failures...should be addressed. The history of the proponent's experience with containment designs and construction material should be described."

Past performance of the nuclear industry does not form part of the justification for developing the AECL Disposal Concept. However, AECL and OH experience relevant to the design of containment systems including such things as the choice of construction materials is pertinent and can be discussed.

6. Section 2.2, para. 3, p.4

"Trends and characteristics of public concern related to nuclear fuel waste management since the beginning of the production of this waste should be described."

AECL will endeavour to meet the Panel's request for information regarding public concern "since the beginning of the production" to the extent that such information can be located.

7. Section 2.3, p.4

"The EIS should discuss the need for long-term management of nuclear fuel waste and the current risks...incurred by the present management of nuclear fuel waste."

Because storage is proven and operational, and because the Disposal Concept does not include storage, the EIS should discuss "present management of nuclear fuel waste" only to the extent necessary to provide context for the Disposal Concept. There should be no additional requirement for a discussion of specific risks, assessment methodology, perceived risks, or risk perception.

8. Section 2.3, p.5

"The discussion should include...pathways and linkages within our social system which enable people to understand and internalize risk perception."

An explanation of the term "internalize risk perception" is requested. AECL also requests the opportunity for further comment once the definition of "internalize risk perception" has been established.



9. Section 3, para. 1, p.5

"The following aspects of the Concept should be addressed throughout this document...areas of knowledge where varying opinions remain unreconciled within the scientific community."

Differing opinions within the scientific community that are relevant and well founded should be addressed in the EIS. However, given the wide range of opinions that exist, and the variations within the range of opinions, it is not possible for AECL to address all differing opinions about the Disposal Concept in the EIS.

10. Section 3.1, p.6

"A comparison should be made of the distribution of risk incurred by current nuclear fuel waste management practices versus that which would be incurred by the Concept."

As discussed in Section 2.4, the need for disposal has been established by the federal and Ontario governments and reaffirmed by parliamentary standing committees. AECL is of the opinion that it is inappropriate for AECL to re-evaluate the need for disposal as appears to be assumed by the Guidelines. Thus, in this context, including in the EIS a comparison of the risk of current practices with the risks of disposal would be inappropriate.

11. Section 3.3, p.6

"The EIS should summarize all major decisions taken during the formulation and development of the Concept; the likelihood of decision reversal and the implications of Concept design and implementation; and to what extent a reversal of these decisions could be accommodated."

AECL suggests that a distinction be made in the Guidelines between the Disposal Concept and the reference design AECL has developed for this assessment. The Disposal Concept can accommodate changes in reference design and therefore the specific reference design used in these case studies need not necessarily be implemented as a part of any possible future waste disposal system. Therefore an assessment of the "likelihood of reversal" of decisions and "to what extent a reversal...could be accommodated" does not seem appropriate at this time.

## 12. Section 3.31, p.6, p.7

"In describing the history of the development of the Concept, the EIS should examine the following: the adequacy of public consultation in the development of the nuclear fuel waste management program...identification of research which may not be completed before public hearings by the Environmental Assessment Panel."

AECL respectfully submits that an examination of the "adequacy of public consultation" is one of the factors that the Panel has been asked to review. Accordingly, it is inappropriate for AECL to comment on "adequacy". However, AECL can provide the Panel with information regarding the public consultation process so that the Panel can assess the adequacy thereof.

AECL assumes that the "identification of research which may not be completed..." is a request for information regarding the "next steps" to be taken with respect to the management of nuclear fuel wastes. If this is not what is intended by the Panel, AECL requests clarification in this regard.

## 13. Section 3.32, p.7

"The EIS should outline the reasons for developing a Concept based on irretrievable burial instead of retrievable storage".

As discussed above, AECL received its research mandate regarding disposal deep in geologic formations of igneous rock, from the federal and Ontario governments, following from the results of the Hare Commission, which were later confirmed by the Interim and Final Reports of the Porter Commission. The governments concluded that the AECL study should focus on one specific nuclear fuel waste management option, namely disposal in plutonic rock, and have now asked the Panel to review the safety and acceptability of that option.

Therefore, AECL assumes that the Panel is requesting background information respecting the means by which the joint governments reached their preferred option for research, as opposed to a re-evaluation of the governments' decision.

14. Section 3.32, p.7

"The advantages and disadvantages of irretrievable burial versus retrievable storage, and implications regarding overall risk, should be explained."

As discussed earlier, the term "irretrievable burial" is not an appropriate description of the Disposal Concept.

Whether the waste is retrievable or not is not the key distinction between present storage practices and an acceptable disposal practice. The key distinction is that institutional controls are required for safety of present storage practices.

As defined in AECB Regulatory Policy Statement R-104, disposal is: "... a permanent method of management in which there is no intention of retrieval and which, ideally, uses techniques and designs that do not rely for their success on long-term institutional controls beyond a reasonable period of time." The general requirement of R-104 gives a limit on predicted radiological risk, calculated without taking advantage of long-term institutional controls as a safety feature. To the best of AECL's knowledge, no one has developed a credible concept for satisfying the general requirement, while making the waste easily retrievable in perpetuity. Nor has anyone designed a credible facility that does not require institutional controls to maintain safety when there is the explicit intention to retrieve the waste at some time (arbitrarily distant) in the future.

Present storage operations require institutional controls to maintain safety, and so are not valid alternatives to the Disposal Concept. Further, the waste must be handled sometime in the future to maintain safety. Therefore, comparison of risks from these storage methods with the risk of disposal is not relevant.

15. Section 3.4, p.7

**"Irretrievable Burial Alternatives. This section should evaluate alternative methods for irretrievable burial...The discussion should include the following - alternative Canadian geological environments; alternative media for irretrievable burial available in Canada, e.g., beneath sea-beds and within ice sheets."**

As noted above in Section 2.3, AECL is of the view that a comparison of alternative burial options was undertaken early in the Nuclear Fuel Waste Management Program commencing with the study undertaken by the Hare Commission in 1977. AECL believes that it is not appropriate for AECL to re-evaluate the decision of the federal and Ontario governments to pursue the option of disposal in plutonic rock in the context of the current review assessing the safety and acceptability of the Concept.

This section of the Guidelines seems to imply that all methods of irretrievable burial are included in the Disposal Concept. Media other than plutonic rock are not part of the Disposal Concept. These are addressed in point 32.



16. Section 3.5, para. 2, p.8

"This discussion should identify the critical stages and expected times leading to the ultimate failure of each component and of the whole system...."

The performance of the barriers, including potential degradation, will be discussed in the EIS. It should be noted that, although gradual changes may occur in the properties or characteristics of components of the disposal system, these do not necessarily lead to abrupt failure in the usual sense of the term and may not lead to degradation in performance. The EIS will discuss the processes that could lead to such changes, including any that lead to component failure.

17. Section 3.5, para. 3, p.8

"A comparison with regulatory criteria adopted for nuclear waste management programs in other leading countries should also be provided."

Since the AECL is responsible for developing regulatory criteria and has formulated the Canadian regulatory criteria, AECL suggests that it would be more appropriate for the AECL to compare Canadian and foreign criteria.

18. Section 3.513, p.11

"(The EIS) should examine the entire proposed vault system, and all aspects of the vault design, construction, operation, sealing and subsequent monitoring..."

Since monitoring of the disposal facility would commence long before sealing, AECL suggests that the word "subsequent" be deleted.

19. Section 3.513, p.11

"The preferred vault system should be compared to and contrasted with alternative vault system concepts developed by waste management programs in other countries, and significant differences should be explained and justified."

In its submission to the Panel at the scoping meetings, AECL indicated that it could assist the Panel by providing it with information regarding international nuclear fuel waste management programs. AECL can provide general information for comparing vault system designs of other countries. However, since AECL's work has focussed on the Disposal Concept developed within the Canadian context, a full environmental assessment of these alternatives would not be practical or appropriate.



20. Section 3.513, para. 1, point 5, p.12

"The EIS must describe...a demonstration of the ability to retrieve...damaged containers during all phases of vault operation."

AECL suggests that the wording "description and discussion of methodology to retrieve", would be preferable to "demonstration of the ability to retrieve."

21. Section 3.513, para. 2, point 1, p.12

"The EIS should describe the vault sealing program including...the criteria to be used in making the decision to seal the vault..."

AECL can describe the general requirements for making the decision to seal the disposal facility which would include compliance with regulatory criteria in place at that time. However, since site-specific criteria could only be considered on the basis of detailed design and site characteristics, it would be premature to present specific criteria.

22. Section 3.52, p.13

"Criteria for the rejection of a rock mass barrier on the basis of its hydraulic, physical, chemical, and biological properties, as well as on the basis of the seismic risk assessment of the rock mass, should be stated."

AECL agrees that the technical factors important in determining the suitability of a site should be discussed in the EIS, as should the criteria that have been put forward by the AECB. While these include a few exclusionary criteria and an overall system criterion for safety, it would be unnecessarily limiting to specify additional rejection criteria based on individual factors. In order to determine whether a site is technically suitable, individual technical features of a site must be considered only in the context of the overall disposal system. Specifying individual criteria for individual sub-systems could preclude flexibility in selecting a site and designing a facility based on site-specific features and should not be required at this stage.

23. Section 3.544, p.19

"The EIS should describe how the response of the physical system...is simulated during all stages of implementation of the proposed Concept."

The EIS will describe how the response of the physical system would be simulated for all stages of implementation, and it will also describe the simulations done for the case studies discussed in Section 2.1.

It should be noted that during the preclosure phase, direct observations of the transient conditions would be possible, so preclosure safety would not depend on simulations. The construction stage, operation stage, and monitoring stage immediately following operation would be simulated primarily to validate models used for long-term simulation. This approach could not be demonstrated as part of the case studies because the Disposal Concept has not been implemented. However, direct observations of transient conditions at field research areas and the Underground Research Laboratory have been used to validate models, and these demonstrations of the validation process can be discussed in the EIS.

24. Section 3.545 and 3.546, p.20

"The EIS should address the possibility that significant radionuclide transport pathways and scenarios may not have been addressed adequately because of conceptual and numerical simplifications made for computational convenience...The EIS should evaluate the adequacy of the computing equipment to accomplish the general simulations while utilizing the full capabilities of the available models..."

It is AECL's understanding that the scientific assessment of the adequacy of the Disposal Concept study is the role of the Panel, with the assistance of the Scientific Review Group. AECL respectfully suggests that Sections 3.545 and 3.546 be reworded so as to require AECL to state its assumptions, and describe its assumptions in conjunction with limitations inherent in numerical and computer modelling simplification, so as to enable the Panel to assess the adequacy of the study.

## 25. Section 3.6, p.20-21

"Characterization procedures must include unambiguous criteria for determining when an actual site satisfies, or how it could be modified to satisfy, the generic requirements for acceptability. Criteria for rejection of a site should also be included. The proponent should define an ideal site, and the likelihood of finding an ideal site."

Since the AECB has established criteria regulating the Disposal Concept, it would not be appropriate to specify additional rejection criteria based on individual factors. In order to determine whether a site is technically suitable, individual technical features of a site must be considered only in the context of the overall disposal system. Specifying criteria specific to individual components of the overall system would preclude flexibility in selecting a site and in designing a facility based on site-specific features.

In siting, the social and political inputs must be recognized and thus AECL believes most of the overall criteria should be developed in cooperation with the public as part of the siting process.

AECL can submit for review the tools and techniques that could be used to evaluate factors relevant to the suitability of a site and for arriving at a decision on whether it would meet regulatory criteria.

AECL is of the opinion that it would not serve any useful purpose to define an ideal site because no ideal combination of factors exists at any real site. AECL can, however, identify important social and technical factors which should be considered during site selection, together with any criteria it has found to be mandatory for technical acceptability regardless of the site.

## 26. Section 3.7, p.22-23

"Facility Construction, Operation, and Decommissioning. The EIS should describe the major activities which would occur during construction, operation and decommissioning of the Concept facility, and the management-related aspects of these activities. This description should include the following: project management, project activities, labour requirements and emergency planning."

Although AECL can provide general information regarding possible approaches to the major activities and resource requirements during operation of such a facility, details such as the project management structure do not seem relevant at this stage of the concept review, but will be important for consideration during the later implementation decision-making process, if the concept is approved as "safe and acceptable".



27. Sections 3.8, 3.81, 3.82, 3.83, 3.84, 3.85; p.24-26

" The EIS should describe the proposed plan for the transport of nuclear fuel waste...discuss the management of the transportation...describe and justify the manufacturing criteria applied to the container system...proposed modes of transport...proposed transport routes...labour requirement...emergency response plan, including responsibilities of parties involved, availability of equipment..."

"The preferred container should be compared to alternative container systems developed in Canada or elsewhere, and significant differences should be explained and justified."

"The EIS should discuss the circumstances and mechanisms leading to all possible causes of container failure."

The technology for transporting used fuel is proven and operating in Canada. Since it is already licensed by the AECSB, it is not necessary to carry out a reassessment of transportation cask technology in the EIS.

The selection of modes and routes would depend on site-specific factors, including public input, related to the selection of the disposal site. No modes or routes are being proposed at this time. The EIS can discuss possible modes of transport and their impacts. Details about labour requirements and emergency response plans depend on both mode and route, and are premature at this phase of the Nuclear Fuel Waste Management Program. Current emergency response legislation and plans, and their applicability to the transportation of used fuel can be discussed.

28. Section 3.9, para. 2, p.27

"The EIS should also contain a risk-benefit analysis of key components of the Concept indicating their costs versus reductions in risk to the environment."

A cost-benefit analysis of individual system components would be necessary for the optimization process preceding concept implementation, but such an analysis cannot be done before that stage because it requires knowledge of site-specific characteristics. A generic cost-benefit analysis would not be meaningful, and therefore a cost-benefit analysis should not be required for the EIS.



29. Section 3.9, para. 3, p.27

"The budgeting and cost control system, and approval processes for additional funding should they be required, must be identified."

As noted previously, since AECL is presenting a concept and a reference conceptual design, details such as budgeting and cost control system are premature in the assessment of the safety and feasibility of the concept. However, the EIS should provide cost estimates for implementing the Disposal Concept.

30. Section 4.1, p.27

"The proponent should define the natural environment that would be suitable for siting and should explain the study strategy that would be used to investigate the baseline environment that exists prior to interactions between the Concept and the receiving natural environment."

Section 4.2, p.28

"The proponent should define the human environment that would be suitable for siting and should explain the study strategy that would be used to investigate the baseline environment that exists prior to interactions between the concept and the receiving human environment."

The principal aim of this section appears to be the presentation of a study strategy for determining the baseline environment. The Guidelines also appear to request that the environment for a site be defined. Since the Disposal Concept has not been developed on a site-specific basis, a specific environment cannot be defined. However, AECL can provide a description of the strategy, or methodology, that could be used to determine that baseline environment, and could include a general description of such an expected environment.

31. Sections 5.1 and 5.2, p.32

"Cumulative effects should be addressed."

AECL requests that the Guidelines be amended to include a definition of the term "cumulative effects" and an explanation of how the information on cumulative effects would be used to determine the acceptability of the Disposal Concept. AECL also requests the opportunity for further comment once the definition and explanation have been established.

## 32. Section 6, p.36

"The EIS should describe alternative methods of managing nuclear fuel waste (excluding irretrievable burial)...discuss...the risks to the health of human and natural environments...identify the means through which nuclear fuel waste may directly or indirectly impact on these environments, and the groups...at greatest risk...comparison of the distribution of risk..."

As noted in point 15, AECL is of the opinion that it is not appropriate to re-evaluate the prior decision to pursue disposal in plutonic rock. However, AECL can provide general information on alternative methods that are being considered or developed for future use in other countries. It should be noted though, that in some instances the technologies have not yet been developed and the information required is not available.

## 33. Section 7, p.36

"The proponent should suggest a plan and process for selection of a facility site..."

The EIS should discuss options for the siting process, taking into consideration information available from AECL's sociological research program. However, interaction with the public to define a preferred siting process (including criteria, weighting, and methodology) should be carried out by the agency which would be responsible for concept implementation and this agency has not yet been defined.









# **ECOSYSTEM APPROACH GROUP**

**P. BOLDRINI**

**COMMENTS ON THE GUIDELINES FOR  
AN ENVIRONMENTAL IMPACT STATEMENT**

**FEDERAL ENVIRONMENTAL ASSESSMENT PANEL**

**NUCLEAR FUEL WASTE MANAGEMENT & DISPOSAL CONCEPT**

**Hamilton, September 10, 1991**

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## Glossary

AEC	= Atomic Energy Commission of the USA
AECL	= Atomic Energy of Canada Ltd.
BEIR IV and V	= reports by ICPR on the Biological Effects of Ionizing Radiation
Biotope	= Bios is life and topos is place
EAB	= Ontario Environmental Assessment Board
EIS	= Environmental Impact Statement
IAEA	= International Atomic Energy Agency, Vienna
IBP	= International Biological Program
ICPR	= International Commission of Radiological Protection
Subject under review	= nuclear fuel waste

## Summary

Some objections and eight suggestions are offered to improve the draft guidelines. They deal with the ecosystem approach that AECL should be following when tackling the subject under review. The ecosystem approach is also advantageous to the Panel in evaluating the same subject. Such an approach is necessary if an acceptable repository is to be found, after 50 years of uninterrupted disposal of this xenobiotic in the Canadian ecosystem. The Panel is open to criticism for not considering all values on which humans base their opposition to nuclear fuel waste. The values are also of cultural, ethical and social nature. Without considering them, the guidelines are incomplete and misleading. Canadians do not tolerate further abuses and smoke screen arguments from AECL, Ont.Hydro and the Panel.

## Foreword

The radioecology of nuclear fuel waste (i.e., the subject under review) studies the concentration and migration of radionuclides in **The Biosphere** (App.A). It also considers the effects of ionizing radiation on the organisms, populations and communities: i.e., **the ecosystem**. Therefore, the starting parameters of the guidelines should be the 23 of Table 1. From Coughtrey et al.(1983) we also learn that at least 100 major radionuclides are involved in the subject under review. By multiplying 23 and 100, we obtain 2,300 major, starting, **physical chemical parameters** to be specified in the guidelines.

**Objection no.1.** *It is not acceptable that the present guidelines be concerned only about the container (permanent repository), but ignore to give a rough indication of the major content: 2,300 physical chemical parameters to start with. If the past is of any guidance, this situation is to be avoided in the future.*

**Table 1.** The major radioecological parameters (1st line in A. and B. below) of nuclear fuel waste in The Biosphere (A) and in the ecosystem (B). AECL should fill the empty spaces of this table with its data.

**A. Concentration and migration of radionuclides (1st line) in The Biosphere (1st column).**

	Concentration of radionuclides	Migration of radionuclides
Air	-	-
Animals	-	-
Humans	-	-
Land	-	-
Microorganisms	-	-
Plants	-	-
Water	-	-

**B. Effects of ionizing radiation (1st line) on the ecosystem (1st column).**

	alpha	beta	gamma
Organisms	-	-	-
Populations	-	-	-
Communities	-	-	-

Another more specific way to start handling the subject under review is the chemical route. The 120 chemical elements in the periodic table are all involved in nuclear fuel waste. The Panel could ask AECL to build an algebraic matrix including all radionuclides; this would begin with 120 chemical elements giving rise to several hundreds radionuclides and 2,300 physical chemical parameters. Multiplying the last two figures we arrive at half a million data. The radioactive decay of each radionuclide is known (Coughtrey et al.(1983) and should also be explicit in the guidelines.

**Objection no.2.** *It is unacceptable that the guidelines be concerned only with the external frame of the container (permanent repository), but ignore the exact nature of the content (the radionuclides).*



A third way to start studying the subject under review is anthropological: investigate the attitude and reactions of the population, such as expressed in the following quote (Cobb, 1989):

"Radiation's power and mystery exacerbate a deep cultural anxiousness... -So long as people worry about nuclear destruction,- said Dr.Weart, -radiation will cause anxiety.- Further, secrecy has shrouded many radiation projects. And with the secrecy have come suspicion and anger, particularly in matters of health and public safety."

The radiation emitted by **nuclear fuel waste** is invisible, mysterious, persistent, pervasive, and surreptitious. It spreads easily to air, fauna, flora, the food webs, soil, water and leaves many traces on the Canadian ecosystem. While the negative effects have been impinging upon The Biosphere, no advantages have ever resulted from them. On the contrary, reprocessing of nuclear fuel waste to obtain thorium, plutonium and tritium (Miller,1991) has been used by other countries in producing the superbomb. This madness only furthers the fears and suspicions of Canadians (App.C and E).

If the population is to take the scientific handling of the subject under review seriously, the Panel must strive to be scientific. This means that, first of all, **current science** must be used to describe the scientific concepts in this field today. Secondly, it means that reference to pseudotechnology (described by Botwell,1984; 1988, and reported again in App.B) must be eliminated in favour of real technology. Only in so doing can the legitimate fears and suspicions of the population be calmed and their trust gained (Babin,1985; Sanger,1981, and many other authors). The following comments and suggestions are offered in the hope that the Panel aims at producing a more accurate and more sensitive set of guidelines.

**Objection no.3.** *No rationale or logical method of dealing with the subject under review is manifested in the draft guidelines. The ecosystem approach(App.D) is the fourth way to start studying it.*

The next section outlines the major deficiency of the guidelines: their neglecting some of the values on which the population bases its opposition to nuclear fuel waste. Then eight specific suggestions are put forward to improve the guidelines. Suggestions one to six (pages 5 to 14), use various aspects of the ecosystem approach. Suggestion seven (page 15-17) is the broadest and most comprehensive on the approach. Suggestion eight (page 18) is the simplest; it is valid for any approach that the Panel might decide to follow. The brief is supported by an extensive bibliography on the ecosystem approach and The Biosphere. Some references deal with the subject under review. Most publications listed in App.F are in the AECL library. Indeed, some of them were authored by them: Hart (1983). The important references of the IAEA (1976; 1979; 1981) are signaled, as well as the six volumes of Coughtrey et al.(1983).

Some expressions in the guidelines are unacceptable per se, or in the misleading context in which they are given. They are ambiguous according to past-present public expectations in Canada. A few of these expressions are quoted, followed by the page in which they are found in the guidelines.

## Ecosystem approach and human values

"A concept like **soclonatural system** is the key, and this concept would require intimate collaboration among several disciplines in order to be effective as a research frame. So the main problem of defining cultural ecosystems becomes one of overcoming the social and cognitive barriers to collaborative work by people from different branches of scholarship. A culturally-oriented ecosystem or soclonatural system concept is largely a structure of cognitive interdependence among people...(Bennett in Moran, 1984; 307)

Biological standards of ecosystemic functioning are thus not sufficient to decide the case. Once again, the system must be re-conceptualized as a socio-natural entity in which humans are defined as responsible components with other components of the system. This means subjecting human interests to a dispassionate scrutiny and making hard choices between these interests. Thus, systemic thinking in the resources field becomes a political process as well as a sociopsychological one. (;306)

The case (conversion of large portions of the North American range to heavy brush cover) also illustrates the tendency for judgements about ecological matters to become intertwined with human purpose and value. (;295)

The role played by humans in ecosystems has been debated for 30 years by anthropologists, biologists, mathematicians, philosophers, and other scientists. "Environmental Ethics", "Environmental Conservation", "Human Ecology" and many other journals deal with it. G.P.Marsh and Aldo Leopold are the two forefathers who first rejected the anthropocentric idea that humans have a special superiority among ecosystem components. They pointed out that humans do not possess the biblical right to dominate nature. Many other authors showed that ecosystems can do very well even without the interventions of humans. Numerous living testimonials support this conclusion. Recently, anthropologists showed also how humans can integrate, correctly, with ecosystems (App.D).

Humans are unique among the ecosystem components: they make wide-spread use of their own power to influence and mold ecosystems. The limits of human intervention, however, are dictated by the self-functioning needs of ecosystems. When human intervention prevents ecosystems from being self-supporting, then it is not integrated with those ecosystems but encroaches upon them, instead. Radioactivity is one such encroaching agent, as shown in many documents: IAEA (1976; 1979; 1981) and the six volumes of Coughtrey et al.(1983). Human activity cannot be xenobiotic and still share in ecosystem evolution at the same time. Humans hamper one or more ecosystem functions using xenobiotics-xenogenetics(App.C). The subject under review is one example of such hampering.

Another characteristic makes humans unique among the ecosystem components: they complement their daily life with intrinsic values: cultural (Table 2, Craik et al., 1976; Evernden, 1985; Jackson, 1985; Simmons, 1989, Vayda, 1969, Watt, 1977), economical, ethical, political (Shrader-Frechette, 1981), social (Hanson, 1986; Fritsch et al., 1980), and technological (Barbour, 1985; Scoby, 1971). These values evolve with generations. E.g., religion was in the value list (Hargrove, 1986). It now seems to be part of the cultural or social values. Ethics was not considered a value in the preindustrial era; for reasons discussed



later, it has become one now. In sum, ecosystems have intrinsic and extrinsic components of their own. The former are the classical ones: energy flow, primary production, decomposition, recycling, etc.

Humans cannot live without nature. They are part of it when they directly integrate within the ecosystem structure and function: i.e., when they are living in harmony with nature: Devall et al.(1985), Dunlay (1988), Jackson (1985), Marsh (1864), Merchant (1979), Nash 1989), Singer (1985), Stone (1986), Taylor (1986):

"If the human use of the physical environment is to be brought into some kind of balance, both human and physical factors must be conceived as a single system, i.e., a system in which human needs are satisfied and the yield of the resource is maintained. As things stand now, human needs come first, and only then adjustments are made in resource practices which may reduce exploitative use... Human needs must be related to environmental ends; the quality of life must be synthesized with --and perhaps politically subordinated to-- the quality of the environment. If ecosystem means dynamic balance between resources and sustenance, this requires a restructuration of human purpose and cultural, political, and moral problems." (Bennett in Moran, 1984; 290)

## Suggestions by the Ecosystem Approach Group

**Objection no.4.** *An imbalance exists between sections 6-7 and 3 of the guidelines: the former are too short, while the latter is too long. In addition sect. 3 is chaotic: one is unable to distinguish the most important ideas from those derived from them.*

### 1. "Natural and human environment(s)"

The Panel should put the Concept into a better framework. As expressed now, the Concept is not intelligible. E.g., the above expression is used many times in the guidelines: page 2(twice), 5, 6, 27 (in the title), etc. These terms have been flagrantly misused and distorted, as shown below with examples from the province which accumulated more nuclear fuel waste than all the rest of Canada together. There is very little of "natural", in the sense previously mentioned, and "human" in the guidelines.

**Example 1.** In 1978 the Ont.Ministry of Housing sent a report to the Environmental Assessment Board (EAB) titled: "Elliot Lake protection from radiation in new construction". This report was intended to answer the concerns of the population who feared an increase in radiogenic cancer. The village, north of Lake Superior, had become the world capital of uranium mining. The government report, however, did not right the previous wrong. First, it hinted at no increase in radioactivity and put forward the hypothesis (a usual mirage) that all the radioactivity was "natural". It then denied the increase in cancer morbidity (the second tactic) and gave false reassurances that there was no link between radioactivity and cancer (the third lie). Finally, it conveyed the misleading impression that by using little construction tricks, radioactivity

could be shut out from houses. In reality the government aimed at keeping radioactivity out of the minds of the people who were being severely affected by it. The government succeeded, temporarily, by fudging its own measurements in a documentable way (Harrison, 1990). It misused instruments to only test for gamma rays: an infinitesimal part of the total radioactivity being emitted (Table 1, B)!

**Example 2.** The EAB buttressed the government lies by following the above report with its 1978 "Report of the EAB to the government of Ontario on criteria and approval procedures with respect to natural occurring radiation in new construction in the Elliot Lake area." This EAB report does not deserve attention, except to pinpoint its additional stack of lies, as unmasked by Harrison (1990). This author documents the destruction of the Elliot Lake natural ecosystem, as others did.

**Example 3.** In 1979 the EAB followed with twin reports which build up on the previous lies and added an additional mound of fresh lies. The new exercise tragically confirmed the prophetic title: "Tortured future of Elliot Lake" (Sat.Night, June 1876). These are the twin reports abusing humans and nature:

- "A public hearing by the EAB into the expansion of the uranium mines in the Elliot Lake area." 37 roman numeral pages, plus 264 others, innumerable tables-plates-illustrations, a map and a folder in pocket.
- "The expansion of the uranium mines in the Elliot Lake area: final report." 480 pages in various pagings, plus colour figures, illustrations, many maps and one folder in pocket.

**Example 4.** What is shown in the previous examples was repeated exactly in the town of Port Hope, north of Toronto, where Eldorado Nuclear set up another deadly uranium shop: Botwell (1984), Sanger (1981), Babin (1985), MacLaren (1978). In Port Hope suspicion mounted when cattle fell ill and gardens failed to grow. Houses were found to be on radioactive rubble salvaged from a demolished radium refinery; radon gas was seeping into their basements. A school had to be evacuated. Runoff from dumps in the countryside was poisoning fields, killing cattle, scaring people and polluting Lake Ontario. This is the "natural" radiation of the EAB! Examples of this kind abound in showing similar patterns (Goldstick, 1987): clandestine emission of radioactivity, cover up over cover up, lies upon lies, spread of cancer (in the name of nature and humans!). The population has more than justifiable reasons to smell this deception!

The reasons for rejecting the abused expression of the title should be clear by now; they are:

- The "natural" environment left in Elliott Lake, Port Hope,... has nothing natural anymore. The same may be said of the "human" environment: for centuries to come the population will heavily suffer.
- The title misdirects the attention on some ecosystem parts, while forgetting the whole ecosystem. This constitutes the piecemeal approach defined by Vallentyne (Boldrini et al., 1990).
- The title misses more than what it includes, and what is included has strong negative connotations;



- the subject under review has Canadian-global consequences; both quantification are avoided in the title. The former is in the "Canadian ecosystem", while the latter impinge upon The Biosphere.

Therefore, it is suggested that the title be replaced either by "Canadian ecosystem(s)" or "The Biosphere", depending on which situation is referred to. These substitutions present the following advantages over the current title:

- they are more comprehensive and specific;
- they draw attention on what is real: **Canada-The Biosphere**;
- they unambiguously quantify the domain of what is being considered;
- they reflect present scientific knowledge and are oriented towards the future;
- they are all-inclusive, considering the natural-nonnatural and human-nonhuman world.

**Suggestion 1.** That the expression "Natural and human environment(s)" be replaced with either: *"the Canadian ecosystem(s)"*, when referring to Canada, or *"The Biosphere"*, when referring to all living things. Other changes should be made in the guidelines, to preserve the true rights of nature and of humans.

## 2. "Baseline environment"

Which one of the definitions of "baseline" (Random House Dict.) is used here? The title is as ambiguous as that of "natural and human environment(s)". From the previous examples, it is clear that the Ontario government inflates the "**natural**" radiation to clandestinely cover up as much generated radioactivity as they can. There has never been a real baseline for AECL! This scenario contrasts with the ecosystem: respecting the rights of nature means not fudging its baseline. The title should then be replaced by "Ecosystem approach". It could be followed by the sentence: "The proponent should detail the ecosystem approach followed in developing the Concept, making separate reference to the Canadian ecosystem(s) and to The Biosphere." The advantages are: clarity, precision, a demonstration that the EIS is honest, correct and documented.

The additional subheadings of this section could then be:

- Ecosystem-biospheric components-indicators, such as: air, animals, ecological damage, climate, humans, land, microorganisms, plants, water: the parameters of Table 1, **plus the food web**.
- Radioecological characterization, decay, decomposition, heat produced by the subject under review;
- Additional value indicators such as: cultural, economic, ethical, political(?), social, and technological;
- Interactions among the components-indicators, including the value indicators (App.D).

In implementing the ecosystem approach, AECL should be inspired by its sister in the USA (AEC):

"It thus came as a surprise to many that the major source of support for the implementation of this new concept (the ecosystem approach) turned out to be the U.S. Atomic Energy Commission (AEC). The AEC was faced with a series of problems that required a systems perspective. First, radioactive fallout injected into the atmosphere fell in unexpected places and concentrated in unexpected organisms and habitats. The AEC needed to be able to predict where and how much radioactivity would be accumulated from nuclear explosions and accidents. Second, the AEC operated several large industrial and test complexes. Initially, they required ecological surveys of the sites and then systems of monitoring the site to determine potential build up of radioactivity. The ecosystem concept was essential here too.

The late J. Wolf of the AEC put together teams of research workers which included groups working in major facilities such as the Savannah River Plant, Oak Ridge, Brookhaven, Hanford and Los Alamos. Studies were also started in Puerto Rico and Argonne National Laboratory, as well as in numerous universities. A large proportion of the active ecosystem ecologists in the U.S. came through these AEC programs sometime in their careers." (Golley in Moran, 1984; 40)

**Suggestion 2.** That section 4 be headed: "Ecosystem Approach" and include: quantification of the Canadian ecosystem and mention of The Biosphere, for the effects outside the Canadian ecosystem(s).

### 3. "Impacts on the environment"

With radioecology (App.A) and with the subject under review (App.B-C), we cannot speak anymore only of environmental impact. This would be superficial and only include part of what is at stake. We must consider, instead, the total impact and the overall consequences: an ecosystem perspective, quantifying **"the" ecosystem**, as opposed to its generic substitutes or parts:

"From the early 1940s aquatic radioecologists have been studying the three R's of radioactive additions to aquatic environments, namely the routes, rates and reservoirs of such additions...

To assess these impacts quantitatively, it is necessary not only to define the distribution of radioactivity in this mobile system but also to understand how it is transferred between the subcomponents in the ecosystem...

From a radiological viewpoint such effects have primarily been considered to be those which impinge directly upon man, i.e. those which might arise from consequent additional human exposure to radiation either from the contaminated environment or from the ingestion of contaminated air, food or water." (IAEA, 1979; 3-7)

As referenced in this quote, the ecosystem impact is much more than the sum of partial "environmental" impacts: it includes the interactions among the components. The most pertinent example is the food web. We speak then of ecosystem impact and ecosystem consequences, while keeping in mind the Canadian ecosystem and The Biosphere (App.D). The following are the reasons for the suggested changes, together with those of cultural, ethical and social nature, dealt with again in the next two sections:



- the environment is three-dimensional; ecosystems are four-dimensional, as is radioecology ;
- radioecological impacts on the environment are only a fraction of the impacts on the ecosystem;
- in the idea of environment there are no cultural, ethical and social values; in that of ecosystems there are these as well as other values-components;
- interactions are not considered when discussing the environment. Interactions, such as climate and food web, are basic components of ecosystems and The Biosphere;
- the environment has some components, but no indicators, because it lacks specificity. Ecosystems are characterized both by their components and their indicators: Best et al., 1983; Soule et al., 1988;
- two indicators stand out prominently in the subject under review: food webs and ecosystem health(Thomas, 1972; 1973). Neither are envisaged or tackled in the environmental approach;
- energy is considered to have little or no direct role in the environment, while it is the ecosystem promoter: a kind of starting engine for ecosystems.

**Suggestion 3.** *That sect.5 be headed: "Radioecological impacts on the Canadian ecosystem and on The Biosphere". The first two subsections should consider respectively: the impacts on health and on the food webs, and the first of them include, but not be limited to, BEIR IV and V.*

#### 4. "Environmental and ethical acceptability"

**"The ecosystem is the total context within which human adaptation and biological evolution take place." (Moran, 1984; 4)**

During the last decades it became clear that the idea of ecosystem had more than a technological dimension. It had a cultural and also an ethical dimension: Attfield (1983), Barbour (1973), Calm (1978), Fletcher (1966), Hargrove (1986), Partridge (1981), Regan (1982; 1984), Rolston (1986), Scheren et al.(1984), Taylor (1986). The ecosystem had progressed to **The Biosphere and ecosophy** (Naess, 1987). Radioecology is the very field where most environmental/ecosystem culture and ethics were violated (see the examples previously shown with suggestion 1). For this reason, ethics is now an ecosystem value and not a disjointed appendix of the environment, as the title would erroneously lead us to believe. Nash (1989) published a history of environmental ethics. The next section deals with culture.

Here is what is known and yet has not been considered seriously by AECL:

"These volumes present the results of a study undertaken for the Commission of the European Communities... The chemical elements reviewed all have radioactive isotopes which could contribute significantly to the radiological impact of chronic releases of radioactivity from nuclear installations within the countries of the European Community, i.e. the major activation and fission products..."

the model parameters recommended are, in general, only relevant to assessment of the radiological impact of releases of radioactivity on man... In the case of radionuclides, there is a general consensus that it is the impact on man from releases to the environment that is important rather than the effect on other components of the biosphere. Here, the main emphasis is on a review of transport through the environment in order to provide appropriate data for calculating the ensuing dose to man." (Coughtrey et al., 1983, XIII-1)

The title is irritating because seems to imply that something ethical was performed up to now. As it was shown in the previous three sections, scientific data were twisted to make AECL look like a respectable institution and its endeavours acceptable. Tricks of this kind add more insult to the radioecological abuses of the past. Unless the public perceives that AECL practices ethics, even the new guidelines on the subject under review are useless. In other words, there must never be separation between ecosystems and ethics (Persson, 1991). If you prefer, ethics interacts with the other values and components. Gone is the time when everything had only either an economic, or a technological, or a political slant. This belief is expressed in the description of something on which AECL cheated the public:

"Tritium is a radionuclide of great interest...

The data produced by the various laboratories participating in the program are unique because the investigations have been carried out in a coordinated manner from the early stage of planning. The results presented allow the user to predict the behaviour of tritium, released as tritiated water, in the major terrestrial ecosystems of the world; the results of a few investigations on aquatic organisms are also reported.

The experimental results on the behaviour of tritium released in elemental or organic forms stresses the importance of the chemical form of tritium released on its subsequent environmental behaviour. Some mathematical modelling on the tritium transfer has been also tentatively carried out, showing the benefit of a close co-operation between the scientists engaged in field studies and the modelers." (IAEA, 1981; 1-79)

The Panel should compare the above quote and book with what AECL states, and published, about tritium. Plenty of it is clandestinely being released in Canada, especially in Ontario, always under smoke screen expressions contradicting this title or the previously mentioned ones. It is not enough assuming now an ethical behaviour by AECL, when its historical practice shows exactly the opposite! AECL should also know that Canadians, like all other humans, became considerably more sophisticated, as expressed under the heading: "Cultural conception, folk model and ecosystem":

"In order to adequately conceptualize the ecological relationships of human groups, it may be necessary to treat them as if they were parts of a functionally integrated, persisting, homeostatic, isolatable ecosystem." (Netting in Moran, 1984; 231)

**Suggestion 4.** *That an ecosystem ethical behaviour by the proponent be shown in the case under review and be explicitly mentioned as the third subsection of sect.5 of the guidelines.*

The next suggestion is the most important among those presented up to now. It is also the most difficult one to grasp, even though a documentation larger than the one available for the other values exists. For this reason, next section starts in an unusual way: with Table 2, a philosophical show.



## 5. Cultural opposition from the population

**Table 2.** A few of the references published in the Journal "Environmental Ethics" on the cultural values as ecosystem components (A) and the need for an ecocentric ethics (B). Many books are found in the bibliography on both of these subjects; see Callicott et al.(1989) or Nash (1989).

AUTHORS	TITLES	<u>Bibliogr. references Environmental Ethics</u>
<b>A)</b>		
Booth A.L. et al.	Ties that bind: Native Americans beliefs as foundation for environmental consciousness.	12(1), 27-43(1990)
Caldicott J.B.	Traditional American Indian & Western European attitudes toward nature: an overview.	4(4), 293-18(1982)
Gardiner R.W.	Between two worlds: humans in nature and culture.	12(4), 339-52(1990)
Hammond J.L.	Wilderness and heritage values.	7(2), 165-70(1985)
Hargrove E.C.	The historical foundations of American environmental attitudes.	1(3), 209- (1979)
Parker K.	The values of a habitat.	12(4), 353(1990)
Rolston H.	Values in nature.	3(2), 113-28(1981)
Sagoff M.	Fact and value in ecological science.	7(2), 99-116(1985)
Sayre K.	Morality, energy and the environment.	3(1), 5-18(1981)
Schwarz O.D.	Indian rights & environmental ethics, changing perspectives, and a modest proposal.	9(4), 291-302(1987)
<b>B)</b>		
Cahen H.	Against the moral considerability of ecosystems.	10(3), 195-216(1988)
Colwell T.	The ethics of being part of nature.	9(2), 99-113(1987)
Merchant C.	Environmental ethics and political conflict: a view from California.	12(1), 45-68(1990)
Partridge E.	Nature as a moral resource.	6(2), 101-30(1984)
Rolston H.	Valuing wildlands.	7(1), 23-48(1985)
Siminson K.H.	The value of wilderness.	3(3), 259-63(1981)
Skolimowski H.	The dogma of anti-anthropocentrism and ecophilosophy.	6(3), 283-8(1984)
Stanley N. et al.	Ecosystem moral considerability: a reply to Cahen.	11(4), 355-61(1989)
Tallmadge J.	Saying you to the land.	3(4), 351-63(1981)
Taylor P.W.	The ethics of respect for nature.	3(3), 197-218(1981)
Thompson P.B.	Need and safety: the nuclear power debate.	6(1), 57-70(1984)
Varner G.E.	Do species have standing?	9(1), 57-72(1987)
Willard L.D.	On preserving nature's aesthetic features.	2(4), 293-310(1980)

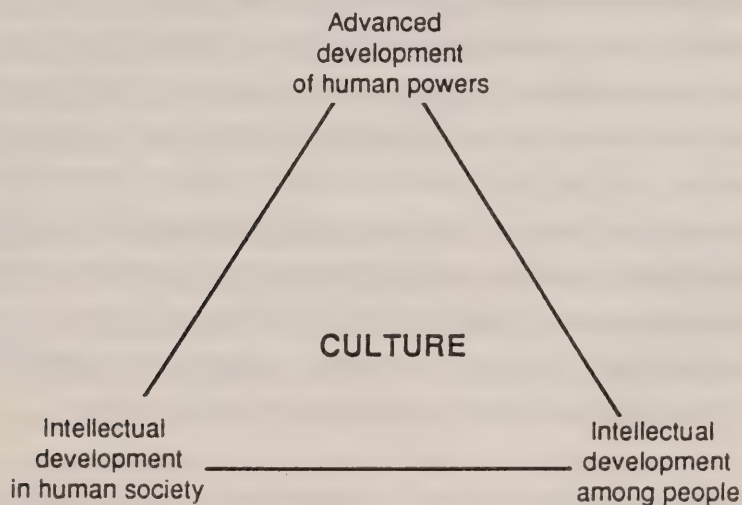
## What is culture?

The first four definitions of "culture" in the Random House Dictionary are: - The quality in a person or society that arises from an interest in and acquaintance with what is generally regarded as excellent in arts, letters, manners, scholarly pursuits, etc. - That which is excellent in the arts, manners, etc. - A particular form or stage of civilization, as that of a certain nation or period: e.g., *the Greek culture*. - The sum total of ways of living built up by a group of human beings and transmitted from one generation to another.

The above definitions represent the three concepts depicted in fig. 1: i.e.,

- The state of social development among people.
- An advanced development of human powers, gained by training and experience.
- The evidence of intellectual development (of arts, science, etc.) in human society.

All the three facets of culture stress the adjective "human" in it, which is exactly what is found in the anthropocentric side of ecosystems. Clearly, culture also has other broader aspects which are exemplified and highlighted by the aboriginal people and by Watt (1977) and Simmons (1989). Therefore, fig. 1 should be in the shape of a polygon, accounting for the aboriginal people's fundamental contribution and for Canadian multiculturalism as well.



**Fig. 1.** A partial definition of culture, which does not yet include the contribution of Canadian aboriginal people. Indeed, the latter would fit better in the Canadian ecosystem.

The culture of an individual, therefore, is both the quality and the set of knowledge possessed by that individual. The culture of a society, however, is related to its civilization and is, generally speaking, characterized as its "heritage". With respect to the subject under review, the knowledge of the population has considerably advanced in the last half century, while that of AECL seems to have considerably regressed. Nothing of what the people learned was positive and advantageous for them or the Canadian ecosystem. By contrast, the damage caused by AECL to the Canadian ecosystem and to The Biosphere is considerable. The population feels, and rightly so, that this tragic farce of AECL must be stopped. Failing that, a sure alternative is available: stop producing nuclear fuel waste immediately. This is the reason for calling the Panel's attention on the cultural opposition of the Canadian public.

### Why cultural objections?

"To describe a human ecosystem is to describe the roles that humans play in the maintenance or mutual regulation of relationships between themselves, or other living species, and non-organic elements with which they interact. Ecosystemic models involving humans organize description around an equilibrium or goal state defined as --carrying capacity-- and interpret the structure of energy flows and the working of regulatory mechanisms in terms of dampening oscillation around this hypothetical point. The habitat, in this view, is seen as the source of limiting factors, be they food items, water, disease or whatever. An objective of the analysis then is to see how the human population avoids coming up against these limitations." (Lees & Bates in Moran, 1984; 134)

The strong opposition to the project under review from the population follows from what the population has experienced (Cobb, 1989). It is an opposition of cultural nature because it is based on what the population has learned up to now: that nuclear fuel waste are mainly a result of the production of nuclear weapons. Indeed, part of the same nuclear fuel wastes (plutonium, thorium and tritium) can be used, and are being used, as the starting point for more powerful nuclear weapons (Miller, 1991). From the ecosystem point of view, there is then more and more damage to be expected from nuclear fuel waste. The most logical conclusion is therefore to stop producing them and not to simulate a remedy, as it has been frequently done. The population does not want to pass on this kind of "nuclear heritage" to future generations (Babin, 1985; Sanger, 1981). They want to end the simulation started in the 1950s under the name of "Atoms for Peace". The culture of the 1990s wants to stop 40 years of abuse.

The mandate and responsibility of Environment Canada, in the brief to the Panel, is described as being:

"The mandate of the department is to foster harmony between society and the environment for the economic, social and **cultural benefit** of present and future generations of Canadians."

Canadians do not believe the above quote, including the reference to cultural benefit, since no results support it. Environment Canada lives on another planet, one without radioecology (App.A-B). These conclusions are drawn from the phraseology of their brief in the paragraphs titled: "Biosphere". They offer pseudoscience, smoke screens, empty expressions and do not deserve the confidence of Canadians.



The Panel and the proponent dream in technicolor if they ignore the cultural opposition of the population. By neglecting it, as happened in the past, they only succeed in making stronger the reaction to the present and future practices. Cultural values are an irreversible part of ecosystem integrity. While there is the possibility of producing nuclear weapons, there cannot be "Atoms for Peace". This point was made clear already many times by many groups. Yet, the Panel did not consider it in the draft guidelines, with the partial exception of pg.30. **Why avoid this Issue?**

**Suggestion 5. That the proponent consider the cultural opposition of the population on the subject under review: that it explain and answer them in their historical and practical reality in the Canadian ecosystem and in The Biosphere. That the proponent consider the cultural values as item 4 of sect.5.**

## 6. "Changing social perceptions"

A new social reality has materialized in Canada. Not only have aboriginal populations started to have a direct role to play on the national scene, but so have many ethnic groups. The former live on the land in a much more direct and intimate way. They see the consequence of radioactivity on the Canadian ecosystem. Some of these ethnic groups came to Canada to escape wars. They can hardly accept being marginalized on a subject of such national importance as the one under review. Almost all of these groups come also from countries where ecosystem damage has been inflicted already under the same pretexts now being used in Canada. In other words, the "minority" groups are also those having better feelings towards The Biosphere and are the new social reality in Canada.

The present guidelines only mention aboriginal claims in sect. 4 and 5. They should do so in sect. 3 as well. They should also take into account that the Canadian scene has changed from the social point of view, since the start of the nuclear history in Canada described by Botwell (1984; 1988). The new social reality in Canada has enlarged the meaning of culture and ethics, as a consequence of its interaction with each of these two values. This is exactly what is now lacking in the draft guidelines. We ask here that the omission be remedied by the Panel and be explicitly included in the guidelines.

***Suggestion 6. That the proponent consider the new social reality of Canada made up of groups in need of broader explanations on the subject under review and who want to be consulted. And that these explanations be delivered in a manner adequate to the social perception of the aboriginal and other minority groups. It has to be stressed that the new social reality of Canada today has led to an enlarging of the meaning of culture and of ethics.***

The next section is more than an overall conclusion. First it justifies the need to follow the ecosystem approach, and then it reiterates its definition and content.



## 7. The need for an ecosystem approach

"Just as the ecosystem concept helped biology broaden its interests to include neglected physical environmental factors, so it affected anthropology. The ecosystem approach provided greater context and holism to the study of human society by its emphasis on the biological basis of productivity and served as a needed complement to the cultural ecology approach. By stressing complex links of mutual causality, the ecosystem concept contributed to the demise of environmental and cultural deterministic approaches in anthropology." (Moran, 1984; 13)

On page 6 of the guidelines "environments" in the plural form is a bad mimic for ecosystems. While ecosystems are defined in all of their parameters, the plurals of an abstract word, such as environment is not. Replacing it with "ecosystems" in the guidelines would be accurate. Obviously, as shown in this and the next section, the substitution would also completely change the reality of the guidelines. Indeed, the impact of the subject under review cannot simply be partitioned into several subimpacts, as suggested on page 6 of the guidelines: "nuclear fuel waste may directly or indirectly impact on these environments". The ecosystem approach is comprehensive and does not make such misleading distinctions. As can be seen in the quote from IAEA (1979; 7), the subunits of ecosystems are its components. Ecosystems are strongly modified by local or partial events, which cannot be missed in the case of radiation. In other words, both the ecosystems and radiation are complex entities with interlinkages.

On page 6 of the guidelines the expression: "social and environmental factors" is used. Again this seems to be the usual erroneous split of what is all-inclusive in ecosystems. It is shown at the beginning of this brief that there are more than social factors to be considered in ecosystems. On page 4 (bottom) of the guidelines "The relationship between the presence of radiation and the incidence ..." is found. It could be better understood if it were: "The cause-effects relationship between radiation and the incidence of health problems should be developed from BEIR IV and V." Finally, it seems that sect.2.3 is not well placed on page 4. It belongs more properly in sect. 5, with an ecosystem perspective added to it. All of the previous objections lead to one conclusion: **there is a need to apply the ecosystem approach to the subject under review.** This subject, unlike any other "environmental" one, has quantitative, proven and global proportions which cannot be hidden:

"For him (Golley), ecosystems provide a bridge between the principles of physics, chemistry, and biology and that relates these principles to actual processes. Ecosystems emphasize the dynamic rather than the static view of systems because of the role of feedback between components." (Moran, 1984; 21)

The above quote expresses the strongly held belief that ecosystem analysis puts together expertise from a wide range of formal disciplines, including most of the physical and biological sciences, economics, and sociology. Such expertise is similarly warranted for the subject under review; yet has not been acknowledged by AECL, Environment Canada, Ont.Hydro, etc. The bibliography shows that there is hardly a discipline which has not been influenced by ecosystem thinking.

## The Ecosystem Approach

"Concepts like that of the ecosystem give us a comfortable sense of precise and rigorous knowledge of the way the environment works... (Bennett in Moran 1984; 289) Ecosystem is really one of the specialized concepts pertaining to empirical systems and consists of a set of generalizations about the interdependent nutritional populational processes of plant and animal species living in defined physical environments... During the 1960s, under the stimulus of the idealistic ecology movement, the concept began to be used by non-biological scientists and commentators in new ways. It was proposed that humans, who disturb natural ecosystems, should model their own uses of the physical environment on that of non-human components of ecosystems and should adjust their resource practices so as to insert human activities into ecosystems without strain to the biotic and abiotic components. " (;292) **If human activities are to be inserted into ecosystems, the system itself has to be re-conceptualized: It is not a matter of -natural- system being invaded by humans, but a complex whole system involving an interaction between the physical resources, animal species, and the human activities. This requires a shift in values as well: human components must be viewed as analytically equal to environmental components.**" (; 302)

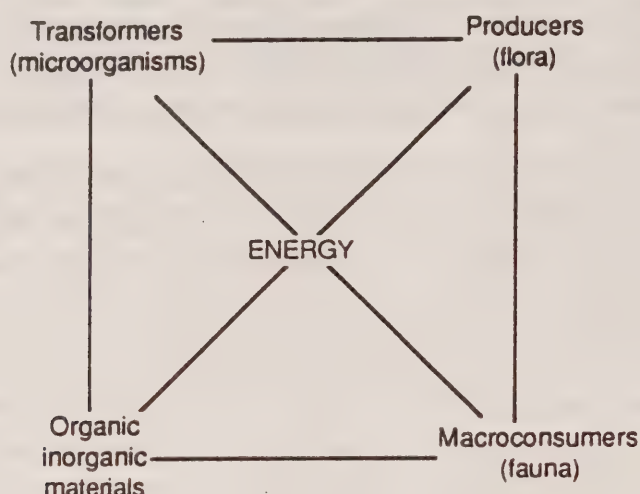
The ecosystem approach is essentially a broad framework of thought designed to help those who have to make decisions to choose a desirable (or sometimes the best - when "best" can be defined) course of action (paraphrase of Holdgate et al.,1978) . It is a compromise between different methods, disciplines and approaches. The contrast between the ecosystem approach and the other types of approaches is outlined in Boldrini et al.(1990). Here, only the interdisciplinary aspect and methodology is being considered. In some sense, the ecosystem approach is also a compromise between the traditionally intuitive solution of complex biological systems and the formal-logic solution of engineering systems through deductive logic. Biological systems, unlike engineering systems, cannot be dealt with in a static way; they are continuously evolving. The procedure for studying static systems is called system analysis and is illustrated in fig.1 of Holdgate et al.(1989).

Ecosystems are living entities, with difficult-to-define space-time boundaries. Ecosystems remedy the previous uncertainty by exhibiting well identifiable structure and functions. Roughly speaking, the ecosystem structure has components and indicators, while the ecosystem functions have only indicators. What distinguishes living systems from non-living ones are the habitats and the mutual intrinsic interactions among the components; both of these properties are dealt with in ecosystem science. The ecosystem approach also deals with the supplementary interactions between the biotic and abiotic world; these interactions are mediated by extrinsic energy. As seen in the section on the ecosystem approach and values (pg.4), ecosystems with humans included in their structure also exhibit values as additional components.

The draft guidelines mainly use technological assurances, at the expense of the non-technological values upon which the population bases its life (Babin, 1985; Sanger, 1981). And even on the technological side, the guidelines are incomplete. It is suggested here that the ecosystem approach is the simplest one and the most comprehensive to apply on the subject under review. It is also the most



credible to start with. These points are expressed in fig.2, where the major ecosystem components are depicted. The guidelines are far from perceiving the importance of these components. Their choices are, instead, a result of a well known method called: "The piecemeal approach", which is selective and incomplete. It was used in the past and has led to no repository being found acceptable by the population. It does not work even when the method is combined with the so-called "Environmental approach". These approaches are contrasted in Boldrini et al.(1990), where several figures are presented.



**Fig.2.** The structural-functional integrity of ecosystems is based on the space-time evolution of fauna, flora, microorganisms (living components), while they use organic-inorganic materials and energy. Radioecology impinges on all of the above components-indicators.

Nuclear fuel waste impinges directly upon all the above ecosystem components. The latter have been comprehensively studied in the series "Ecosystems of the World" and are also illustrated in about 50 books of App.F. The guidelines should then account for the difference in the environment-ecosystem perspective: the former is not documented anywhere. The public is likely to accept an approach to the subject under review broader than any of the others tried up to now. This point was graphically illustrated in Boldrini et al.(1990), together with the fact that the ecosystem approach accounts also for the human values. In its wholeness the ecosystem approach answers the fears of the population: nuclear weapons, unethical behaviour, unaccounted cultural values, marginalization of part of the Canadian "minorities", etc.

**Suggestion 7.** That the proponent be encouraged to fully adopt the ecosystem approach in considering the subject under review.

## 8. A repository close to nature

"It was emphasized in various contexts during the seminar that to minimize as much as possible the risk of long-term negative effects on the environment, we must seek to create systems that are closely allied with nature itself...The repository must be constructed as a system in harmony with nature. In other words, materials found in nature would be sought for construction, and the observations which can be gleaned from the natural world could be compared with various natural systems to arrive at -natural analogies-." (Persson, 1990)

"aphorism: *the further our cleverness departs from nature's well worked patterns, the greater the likelihood that the clever action will have unintended consequences* -ones likely to injure humans and the environment. We have not had time to find out what those consequences might be, whereas nature has had hundreds of millions of years to experiment and to find out what works... we should temper our cleverness by studying and emulating nature."(Milbrath, 1989; 19)

The draft guidelines, on page 21 and in other places, do not show anything similar to the spirit of the above quotes and the writings of many authors on the rights of nature. Canadians are highly sensitive to this perspective, which has a human merit, as can be deduced from Anglemeyer et al.(1984) bibliography.

**Suggestion 8.** That the proponent build a repository close to nature, according to the suggestions of Persson (1990) and the many authors asking to recognize the rights of nature (top pg.5 here).

## Conclusions

"It may be more important now than ever before in history for scientists to keep the doors of their laboratories open to political, economic, social, and ideological currents... The global environment cannot be separated from political, economic, and moral issues. Environmental concerns must permeate all decisions" (Gro Harlem Brundtland in DeFries, 1989; 11, 18)

Unless the Panel and the proponent account for the opposition of the population, there will not be an acceptable permanent repository of nuclear fuel waste in Canada.

Apply to the subject under review the equation: **CAUSE = EFFECTS x OPPOSING REACTION.**

Even small radioactive effects are now being multiplied by an escalating opposition of the population and blow the right hand side of the above equation out of control(App.E). This is then a call to reality, supported by a world-wide ecosystem movement(App.F). It comes from evaluating the Canadian ecosystem, not something academic or extraterrestrial(App.D). The escalating fears of Canadians are of cultural, social and ethical origin; they originate from the fact that the biotic components of The Biosphere accumulate radioactivity (Whicker et al., 1990). These fears are not healed by technological-economic explanations, and even less by pseudo-technological ones(App.B). The public opposition is grounded in the historical abuses and aberrations by AECL (Botwell, 1984; 1989). Here is another aberration:

"Scorched by the bomb, Hiroshima survivor Busuke Shimoe, 85... His wife and daughter were among the 210,000 who died in 1945 from the bombings of Hiroshima and Nagasaki. He is fighting cancer, a possible long-term effect of his exposure." (Cobb, 1989)



Mr. Shimoe's cancer is more than a "possible" long-term effect of his exposure, as demonstrated in BEIR IV & V. This year another 4000 Japanese deaths from radiation cancer were added to the list kept in the Hiroshima memorial! With the present guidelines, the Panel continues to go around in circles. Many of these points were made in Porter (1978) and were not implemented. The population does not tolerate these tricks anymore (Miller, 1991), especially after Chernobyl (Edwards, 1987). The guidelines do not give any assurance in this respect. For this very reason, they are objectionable as many of the previous (unkept) assurances. The Panel should use the language of reality and the Dictionary of its choice, but should avoid the misleading phraseology of Environment Canada, AECL, or Ont. Hydro.

The ecosystem approach should be applied in the EIS and the guidelines. Here is a summary:

- The ecosystem approach is the only paradigm integrating cultural, economic, ethical, political, social and technological short-term values with the long-term evolution of nature (App.D).
- It is not a new approach, nor has it been discredited like the piecemeal-environmental approaches which, instead, are being used in the draft guidelines.
- "Most of the authors agree that the ecosystem concept has been a useful heuristic tool in conceptualizing the unity of physical abiotic and biotic systems, in promoting detailed quantitative data collection on a broad array of system components and relationship, and as a framework within which to test hypotheses on people/habitat relationship." (Moran, 1984; V)
- The ecosystem approach is not a pseudoeconomic approach (such as that of Ont. Hydro in promoting nuclear power), but is one that applies perfectly to the subject under review.
- It is a simple, basic, clear approach, which starts by defining the specific ecosystem components-indicators, including humans, their interactions with the subject under review and radioecology (App.A).
- It is a dynamic approach with a time dimension. The approach overcomes the classical limitations and selectivity exemplified by "the environmental and socioeconomic effects" (pg.1, line 9).
- The ecosystem approach to the subject under review is holistic and directly matches the impacts and consequences of radioecology on all components of the Canadian ecosystem and The Biosphere.
- It also addresses the opposition of Canadians, which is based on the fact that the ecosystem values (especially the cultural, ethical and social ones) have been ignored by the other approaches (App.F).
- The ecosystem approach, as described in this brief, has answered even the four objections of the anthropologists put forward, during the last 10 years, by Moran (1984; 1990).
- The ecosystem approach was applied by the USA AEC, and there is no reason why AECL cannot learn from them how to implement it (page 8 here).

**Acknowledgement.** Mary Boldrini spent many hours to correct the versions of this brief.

## Appendix A. Radioecology

"Radioecology, a branch of ecology that studies the concentration and migration of radionuclides in the biosphere and the effect of ionizing radiation on organisms and their populations and communities, or biocenoses. The principles of radioecology were formulated by V.I. Vernadskii in the 1920's in his work on the biogeochemistry of radioactive substances and by the Czech scientists J. Stoklasa and Z. Penkav in their monograph "The biology of Radium and Uranium (1932)". Radioecology became firmly established in the mid-1950's, after the creation of the nuclear industry and nuclear testing, which resulted in global environmental contamination by radionuclides of strontium, cesium, plutonium, carbon, and other elements.

Radioecology usually deals with very low rates of chronic external and internal irradiation of organisms. Under natural conditions, organisms are subjected to irradiation from natural background radiation (including cosmic rays and the radiation from natural radionuclides of U, Ra, and Th) and also from the radioactive contamination of the biosphere by artificial radionuclides. However, many plants and animals can store radionuclides in their vital organs and tissues, which affects the migration of radionuclides in the biosphere and greatly intensifies internal irradiation. High rates of irradiation that act on the cellular genetic apparatus increase the rate of hereditary variability; even higher rates decrease the viability of organisms and result in the extinction of those populations that are most sensitive to ionizing radiation. The structure of biocenoses is thereby altered and the interactions between the species that occupy these areas is weakened.

The establishment of the patterns underlying these processes is very important for many branches of the economy. Of practical importance are the following problems that are studied by radioecology: the migration of radionuclides in food chains (including those of farm animals and man), the disintegration of ecological relations, the deactivation of farmland and bodies of water contaminated by radionuclides, the exploration for surface deposits of radioactive ores using the radioactivity of indicator plants, and the detection of land and water areas contaminated by artificial radionuclides. The wide range of problems studied by radioecology has led to its subdivision into marine, terrestrial (including forest and agricultural), veterinary (with the related science of radiation hygiene), and freshwater radioecology..." (Great Soviet Encyclopaedia 21, 425(1978).

## Appendix B. More faulty statistics

"Although there is no question that the total radiation exposure is growing, the absolute amount is debatable. That's because the techniques for measuring exposure are about as primitive as most nuclear-waste management practices. The doses are calculated from readings taken from monitoring devices that are worn by workers and visitors at nuclear facilities. The badges are processed much like film, or scanned by machines, to calculate individual doses.

Surveys have shown that laboratories that process the badges misread 50% or more of them. Even if the processing were expert, many radiation readings would still be inaccurate because dosimeters vary in effectiveness with the type of radiation. That was established during the Three Mile Island accident, when the accuracy rate of dosimeters dropped below 20%. Furthermore, the badges cannot measure low radiation doses. An employee could receive as much as one half the dose permitted in a year, while the dosimeter would register no radiation exposure at all. Even the NRC has acknowledged that current



practices leave much to be desired. In regulations for dosimetry standards proposed in January 1984, the agency said that: -tests have indicated that a significant percentage of personnel dosimetry processors may not be performing with a reasonable degree of accuracy.-

Despite the faulty numbers, the federal government relies on them to show that nuclear workers are not exposed to more radiation than legally allowed. The Department of Energy declared that 45,054 employees at federal nuclear installations received a measurable dose of radiation in 1980. Of that number, 29,384 reportedly received less than one tenth of a rem, while 16 received between 3 and 4 rems -the highest exposure. The NRC compiles similar information on workers at nuclear power plants. Some of the most damaging evidence of the crude state of radiation measuring came in a 1982 trial in Salt Lake City. The litigation was initiated by families who lived in Utah, Nevada, and in Arizona during above ground atomic bomb tests. They claimed they were exposed to harmful levels of radioactive fallout. U.S.District Court Judge Bruce S. Jenkins handed down a historic decision in the case in May 1984, becoming the first judge to hold that government-approved levels of radiation exposure caused the death of unsuspecting citizens. Jenkins found that fallout had induced the cancer that led to the deaths in 10 of the 24 cases consolidated for the trial but that it was not a factor in the other 14 cases. He awarded \$2.66 million in damages to the families of nine victims; the amount for the tenth, who died after the trial, was to be fixed at a later date. The case was the first in what is expected to be a series of trials growing out of nearly 400 lawsuits filed by cancer victims or their families.

After hearing 13 weeks of testimony, Judge Jenkins took 17 months to write a formidable 419-page opinion. One of his critical findings centered on the veracity of the government statistics that purportedly showed how much radiation each victim had received -even though it had not monitored them or anyone else in the general population at the time of the tests. He wrote, 'The negligence reflected in the monitoring program is highlighted by the fact that even now we have more direct data concerning the amount of strontium 90 deposited in the bones of the people of Nepal, Norway or Australia than we have concerning residents of St.George, Cedar City or Fredonia.' Regarding the AEC's decision to give dosimeters to government employees involved in the tests but not to people living in the vicinity, the judge said, 'The scientific justification for monitoring workers directly, but not the people around them, especially children, defies the imagination.'

Although the government took no readings of people at the time, it still introduced precise figures for the amount of radiation that the victims had received more than 20 years earlier to support its contention that fallout could not have caused the cancers. With the aid of computer models, it also calculated the radiation exposure to specific organs in the victims' bodies. Judge Jenkins singled out the data on one person, Glen S. Hunt, to show the absurdity of the calculations. Born in 1920, Hunt lived in Utah from 1951 to 1959, when the tests were carried out. He was diagnosed as having cancer of the pancreas in 1978 and died in 1980. An elaborate government chart entered into the record listed the exact amount of radiation that Hunt's organs received from 20 radioactive substances. For example, the government chart showed that Hunt's pancreas received 0.00126 rems of radiation from cesium 137.

'There are at least two aspects of this evidence which can be misleading,' Judge Jenkins wrote. 'The use of -significant- figures, a strontium 90 dose to the pancreas of 0.0000220 rads, not 0.0000222 or 0.000018, or some different amount, and the precision of the stated figure is betrayed by its potential for inaccuracy. The potential error in the stated figure compared to whatever actual dose was received is far greater than the figure itself. The real amount may vary by a factor of 2, 5, 10, 100 or more, depending on real, unreconstructable events.'

But there were more telling entries in the chart than the computerized guesswork. Government experts had calculated that Glen Hunt's ovaries had received a radiation dose of 0.0000574 rads from cesium 137, and that his uterus had received a dose of 0.0000715 rads. Judge Jenkins, who had a clearer grasp of anatomy than did government scientists, observed, 'Glen Hunt, like almost all men, had neither ovaries nor a uterus.' " (Barlett et al., 1985)

## Appendix C. Nuclear fuel waste is xenobiotic

The purpose of this appendix is to indicate how radioactivity impacts upon humans\* and to define a xenobiotic, xenogenetic, etc. These properties justify the historical phobia of the population toward the subject under review, especially when its emissions come in contact with the body.

"The various processes of release, dispersion, and food chain accumulation of radionuclides represent a transfer from source to man. Various models have been developed to represent this transfer and data concerning the various factors involved were collated in the volume: "Radioactivity and human diet" edited by Scott-Russell in 1966. More recently, Johns reviewed the various environmental pathways involved in the transfer of radioactivity to man and noted that there was an enormous fund of knowledge about these pathways and a very detailed and extensive literature on the subject; however the extent of this literature was considered to be an obstacle to the non-specialist in forming an impression of the relative importance of these environmental pathways in causing irradiation of man. Man not only represents the upper level of the food webs but is also the subject of particular interest when considering the regulation of release of radioactive materials to the environment.

Assessment of the radiation dose delivered to man following ingestion and inhalation of radionuclides is not considered in this report., neither is discussion of the external irradiation of man from radionuclides incorporated into his environment included. With regard to internal dose, it is noted that the ICRP has given metabolic models and a detailed numerical summary which allows intake of radionuclides to be converted to cumulative tissue doses for a wide variety of body organs and tissues. These results apply only to adult workers and the ICPR has cautioned that they -do not recommend the use of the data and models described... to estimate committed dose equivalent to members of the population...by adjustment solely on the basis of differences in mass organs or magnitude of intake-. Factors which need to be considered include:

- effects of incorporation of the radionuclide into dietary materials;
- difference in biological retention between children and adults and between healthy and diseased individuals;
- differences in metabolism caused by local variations in metabolic status, particularly because of variations in the intake of essential trace elements, and
- differences in dosimetry due to differences in body size between children and adults.

These factors are under discussion by the ICPR, but as yet no formal recommendations are available. With regard to external dose, the four main routes of exposure are:

- exposure to a cloud of a radioactive gas or aerosol;
- exposure to activity deposited on the ground or on vegetation;
- exposure in close proximity to a contaminated water body; and
- exposure by submersion in a contaminated water body.

In addition, individuals can be exposed to external irradiation from material deposited on the skin." (Coughtrey et al., 1983; 6)

The Random House Dictionary defines "xeno" as being: "A learned borrowing from Greek meaning - alien- , -strange-, -guest-, used in the formation of compounds words." Therefore, nuclear fuel waste has the following **xenoproperties**, where xeno has all the above three meanings:

- **xenobiotic**: living organisms handle radionuclides as foreign bodies, at least those radionuclides which do not exist in nature and do not have a life cycle of their own (Coughtrey et al., 1983; Swain, 1981).
- **xenogenetic**: many have seen examples of this property in TV broadcasts from Chernobyl: where, pines were transformed into firs, and viceversa . Other examples are listed in Hart (1980).
- **xenomorphhc**: pertaining to rocks without their characteristic crystalline forms, but one forced upon them by other constituents of the radionuclides. This follows the long-term radioactive decay.
- **xenophobic**: is a repulsion manifested with respect to many chemical-physical reactions.

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\* All the references and figures which are in the original text were omitted here.



## Appendix D. Operational definition of ecosystem

\*The term **ecosystem** has become widely used in English-speaking countries. It expresses technically the common sense idea that everything is related to everything else. It is culturally useful since it expresses nature in physical mechanical terms, de-emphasizing the biological-evolutionary aspect, and links directly to computer science and information theory. It is therefore a manipulative, in contrast to a relational, term. I suspect that these system-relative features of the term have been influential in making it so widely acceptable.

In this context, the ecosystem may be defined operationally as follows. First, the ecosystem is conceived as a black box, containing both biological and nonbiological elements. These are the elements found together in a biotope. The boundaries of this box are difficult to define because the biological and nonbiological elements are usually distributed over space in continuous rather than discrete patterns, but the boundaries must be stated nevertheless. In most studies boundary problems are solved arbitrarily, being defined to fit the objectives of the study.

Second, the behavior of ecosystem is defined as the ratio of inputs to and outputs from the blackbox. This process of conversion of a set of inputs into a set of outputs is an expression of the system's behavior. Inputs and outputs are in terms of energy or materials. This set of behaviors of an ecosystem is influenced by external factors --the environment of the system-- and by internal factors --the interaction between the biota and between the biotic and abiotic elements of the system. Observation of the behavior of a series of ecosystems leads to identification of consistent and inconsistent patterns, which in turn lead to formulation of hypotheses which state the relationship between internal and external factors and the input-output ratios. Hypotheses may be tested experimentally.

Third, the pattern of ecosystem behavior, then, are interpreted in the context of a larger ecosystem of which the ecosystem of interest is an element and through the behaviors of subsystems of components within the black box. Thus, one can arrange ecosystems in a hierarchy of systems, as Tansley (1939) pointed out. The problem of ecosystem boundaries, significance and applications are all solved when one considers the ecosystem of interest as one of a set of systems which collectively make up a system at the next higher level in the hierarchy of organization.

In point number two above, the interactions between the biological and physical components of ecosystems involve feedback and complex networks across which material, energy and information flow. However, recently, ecosystems have been described as noncybernetic systems by (1979)... This analysis raises questions about how we are to think about ecosystems and, as Patten & Odum (1981) commented in their rebuttal to Engelberg & Boyarsky, how we are to place ecosystems within the scheme of known systems. Both Patten & Odum (1981) and Jordan (1981) provide examples to refute the criticisms of Engelberg & Boyarsky. Jordan reasons from coevolutionary examples that it is inconceivable that such complex networks described by ecologists could have arisen by accident, while Patten & Odum present an elegant systematic analysis of the issue with ecological examples. They conclude:

"We believe that to understand the organism in nature, its other half, environment, will have to be understood as well. To us, -environment- means environment unspecified. The ecosystem is the level of organization concerned with orderly, not chaotic, processing of energy-matter in the biosphere. We do not believe that it is the goal of ecosystems to do this. They are not superorganisms. Rather it is a constraint of existence that if living processes are not orderly, antientropic, then they will not persist. The balance of nature calls for a conjugate action-reaction kind of organization that creates order where could be chaos as a matter of implicit design that simply evolved over geological time."

This leaves us the final topic to consider; the key questions that deserve attention by students of ecosystems. I feel that there is a large set of such questions. They include the following:

1. Tansley (1939) introduced the ecosystem concept in the context of **system equilibrium**... In operational terms we would define an equilibrium as a state where the inputs and outputs balance and the storage within the system remains constant. Does an equilibrium occur?

Technically this is a difficult question because the response of an ecosystem to the environment may require hundred of years before a semblance of balance is achieved. But further, is it more realistic to conceive of a directional process which has a built-in linear force toward an equilibrium state or is it more

reasonable to consider an ecosystem as an adaptive system responding to the external environment and changing its behavior as the environment shifts and as biological evolution occurs within it? The adaptive model appeals to me, but the question is open.

2. Do ecosystems undergo senescence and death? Clearly, ecosystems go extinct. Those of past geological epochs can only be recreated in an Abstract sense with great difficulty from fossil and pollen records. Equally clearly, some ecosystems become senile. For example, organic matter builds at a rate faster than the rate of decomposition and system behavior become slower and slower. Ultimately, the system changes. Is this analogous to senility and death?

3. Ecologists generally neglect the question of the boundaries of ecosystems, establishing them for convenience where an apparent discontinuity occurs. However, the location of a system boundary is not a trivial problem. A boundary implies a discontinuity in either the nature of the system structure or in the rate processes, or both. Watershed studies have been especially effective because the watershed, by definition, is limited by the flow of water into and out of the system. Lakes are also easily bounded systems; but this is not true of other commons systems. How does adoption of arbitrary boundaries in a continuous universe bias the study of system behavior?

4. We understand that both physical and biological processes are operative within the ecosystem. We do not understand the balance between these different forces as the environment and habitat changes. In systems which are strongly regulated by physical process --the open ocean, for example-- are the behaviors of ecosystems and their components more predictable than in a tropical rain forest where biological processes are dominant? Patten (1982) has recently argued that direct cause and effect is not very significant in explaining ecosystem behavior. Rather, he finds that indirect causality stemming from the interactions and feedback in the networks explains a larger, actually much larger, proportion of the behavior. If so, does this effect vary in systems under physical versus biological control?

5. Finally, I will ask, what are the hierarchies of subsystems between what the ecologist would call the community ecosystem and the population? The subdivision used in IBP was the trophic level (that is the primary producers, the consumers and decomposers). The supralevel used by the population ecologist is the food chain, in which three or more populations are coupled together through the exchange of food and being eaten. There is a gap between trophic levels and food chains so that the ecosystem scientist and the population ecologist/biologist find less in common than they should. What are the hierarchical levels between ecosystems and populations? This is an area where substantial advance might be possible once we have adequate data on the entire food web of a community. But to describe an entire food web is a very difficult task and has not been completely carried out anywhere as far as I know.

## Man in the ecosystem

Let me finish by making a few comments about anthropology. I have consciously avoided saying anything about man because I have emphasized the biological ecologists', rather than the human ecologists', perspectives. Frankly, I find no problem in including man in the ecosystem concept. However, for most biological ecologists, the systems of interest are spacially so small that man can only be an external factor -- part of the system's environment.

When the ecologist moves to larger systems --regional systems or landscapes-- man becomes an actor within the system and can be treated as such. However, man is unique in creating culture. This unique ability of man requires the ecosystem analyst to include history within the study and that makes it more difficult.

The word **ecosystem** can now be found in legislation, in regulations and in the popular press. In these usages it frequently conveys a concept of interaction or of integration of units into an interacting system. As such, it is a code word to express the common sense idea that everything is interacting with everything



else. While this element is in the ecologist's concept of ecosystem, the technical concept is actually much richer in association and meaning. It reflects the hierarchy of organization from the universe to the atom; it emphasizes the dynamic, as contrasted to the static, element of systems; and it provides a bridge where principles of physics, chemistry and biology can all be brought together and related to actual processes. I conclude by observing that ecologists have never been especially interested in creating a taxonomy of ecosystems (as they did for plant communities and geographical regions). The fact that the concept is used in a variety of ways may be a sign of immaturity. It may also be a sign of its dynamic utility." (Golley in Moran, 1984; 43)

### More operational hints

"Evans extended-refined the ecosystem concept & identified the major components of an ecosystem as

1. the living parts where energy and matter are fixed, circulated, transformed and accumulated by photosynthesis, decomposition, herbivory, predation, parasitism and other activities forming complex food webs, and

2. nonliving parts where energy and matter are fluxed and cycled by evaporation, precipitation, erosion and deposition. He also stressed that ecosystems are open relative to these fluxes and that the inputs and outputs of energy and matter link individual ecosystems together within the biosphere of our planet...

Ecosystems are considered to have structure and function (Odum, 1971). The structural components of an aquatic ecosystem include the physical feature such as the water and sediments of a lake, the gradient of conditions such as found in the epilimnion, metalimnion and hypolimnion of a thermally-stratified lake, or the biotic composition such as species and numbers of individuals and their biomass. Metabolic and biogeochemical activities characterize the functional aspects of ecosystems, such as photosynthesis, decomposition, flux and cycling of water and chemicals.

At this point it is useful to distinguish between flux and cycling in ecosystems as these two concepts are often confused. **Flux** refers to movement, input and output, across the boundaries of an ecosystem. Quantification of flux is the basis for constructing budgets (input, output, net change) and for identification of flux patterns, which give rise to hypotheses that may be tested by detailed studies within the boundaries of the ecosystem. The biota and the nonliving components within the boundaries of the ecosystem respond to, as well as alter these external fluxes. **Cycling** refers to the exchanges of materials among various living and nonliving components within the boundaries of the ecosystem. An understanding of cycling provides an explanation for the factors that give rise to particular flux patterns...

Ecosystems also have a history. An understanding of history is vital for evaluating present day relationships or for predicting the future state of an ecosystem. E.g., changes in climate, soil development, successional patterns of vegetation, eutrophication and pond filling, or short-term factors such as changes in water quality and thermal structure, all affect the current structure and function of the ecosystem, as well as the potential for future growth and development." (Likens, 1985; 1)



## Appendix E. Nuclear race still in full swing

by Douglas Roche

"The fanfare surrounding the Bush-Gorbachev summit in Moscow next week will undoubtedly create the impression that the nuclear arms threat has gone the way of the Cold War. This is a delusion.

Of course it is right for the world to celebrate the first actual reduction in strategic nuclear weapons (long-range) that the START treaty represents. We must be thankful that the relaxation of tension between the United States and the Soviet Union has produced this step.

But, as Tariq Rauf of the Ottawa-based Arms Control Centre points out, at the end of its seven years implementation, START will reduce the total number of nuclear warheads deployed by the Soviets and Americans by just 20% to 18,435 from 22,922. That's as many as both sides had when they began the START negotiations nine years ago. Most of the weapons being reduced will be older systems; START does not prohibit modernization and both sides will continue to develop new systems of nuclear weapons.

Some disarmament.

We are entitled to ask why, in this new era of cooperation that the emerging new world order is supposed to stand for, the U.S. needs 10,395 warheads and the Soviet Union 8,040 plus thousands of short-range nuclear weapons.

There is no logical reason for such overkill capacity, bearing in mind that the smallest of these weapons is eight times more powerful than the bomb that destroyed Hiroshima. The fact is that, the end of the Cold War notwithstanding, both sides are still locked into a Cold War military mentality in which the hard-line strategists constantly evoke -worst case- scenarios of the damage the other side could inflict. This perpetual expectation of the first-strike capability of the other side and the need to counter it with even more devastating retaliatory weapons is the outcome of the strategy of nuclear deterrence.

Nuclear deterrence means you can't let go. NATO keeps insisting on a -mix- of nuclear and conventional weapons deployed in Europe. The U.S. adamantly refuses to stop nuclear testing. Gorbachev is desperately trying to convert military spending into productive civilian uses, but his generals won't let him throw down the Soviet nuclear weapons programs while the West is still arming.

The smiles and embraces in Red Square next week are nice, but don't be fooled that the arms race is over. The U.S. (which is cutting its defence budget only 5%) is continuing to develop the -stealth- B-2 strategic bomber, the Trident II (D-5) submarine-launched ballistic missile, the advanced air-launched cruise missile and the 10-warhead MX ICBM and other new systems. The Soviet Union is pursuing the 10-warhead rail-mobile ICBM, Typhoon and Delta IV-class nuclear submarines and the Blackjack strategic bomber.

Robert McNamara, former U.S. defence secretary, is leading a campaign to get the U.S. and Soviets to accept -minimal deterrence- by which both sides would cut nuclear weapons down to 1,000 each. That would be a tremendous step forward, but there is no political will in the Bush administration to begin to move in this direction. Negotiations for START II are not even being talked about.

Canada has a lot at stake in this inertia because the START agreement will lead to more cruise missiles and upgrading of northern defense across the top of Canada. The Canadian government ought now to be pushing Washington and Moscow to negotiate lower strategic bomber and cruise missile levels in START II.

But as the Arms Control Centre says, Officials apparently are concerned that raising Washington's ire on strategic arms control issues risks possible retaliation in other important issue areas, such as bilateral trade relations and environmental protection-. (The Toronto Star, Thursday July 25, 1991; A19)

Douglas Roche was Canadian ambassador for disarmament from 1984 to 1989.

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## Final Comments on Draft EIS Guidelines

In general, Energy Probe would like to reiterate its previously submitted comments on these matters, contained in Notes for Oral Presentation on "Scoping" of October 22, 1990, and Supplementary Presentation on "Scoping" of November 28, 1990. While a few of those suggestions have been incorporated in the draft EIS guidelines, most have not, in our view, and we consider their absence a serious failing in these draft guidelines. We commend those submissions to you, and hereby request and recommend once more that their suggestions for guideline issues be incorporated in the final EIS guidelines. We also note several comments and passages in those submissions that relate to fundamental problems with your Panel's Terms of Reference or with the Panel's conduct to date -- problems not easily redemiable by the simple incorporation of text in the guidelines. We hereby commend those comments to you as well, and reiterate their importance to the legitimate investigation of the vital issues your Panel has been charged to resolve.

Finally, we note the Government's recent cancellation of the proposed "joint ministerial task force" to discuss "the environmental impacts of different technologies for generating electricity," the last pretence that there would be an opportunity for public discussion of the wisdom of creating additional enormous quantities of incredibly toxic and long-lived wastes, whose final disposal your process is to assess. That now-cancelled "joint ministerial task force", as we have noted in earlier presentations, would itself have only been a poor substitute for a necessary -- and promised -- public discussion of "the energy policies of Canada and the Provinces and the role of nuclear power in those policies." In short, this FEARO process has not only been stripped of the opportunity to discuss the "three R's" of waste disposal, but it has also been stripped of any proper context that could have made its deliberations meaningful or appropriate at the current stage of nuclear-energy decision-making in Canada.

We are available to discuss any or all of these issues with FEARO staff or Panel members, and will look eagerly for any signs of movement from FEARO in response to these submissions.













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Chairman, Environmental Assessment Panel reviewing  
Nuclear Fuel Waste Management and Disposal  
Fontaine Building  
200 Sacre-Coeur Blvd., 13th floor  
Hull, PQ K1A 0H3

Dear Mr. Seaborn,

Nuclear Awareness Project appreciates the opportunity to comment on the proposed guidelines for the Environmental Impact Statement (EIS) to be prepared by Atomic Energy of Canada Limited. However, we have chosen not to comment on the EIS guidelines specifically, since fundamental issues are not being dealt with by this Environmental Assessment Review Process under the current Terms of Reference.

There is an underlying assumption that the problem of high level nuclear waste disposal must be dealt with urgently. In fact, this is true only from the nuclear industry's public relations point of view. We are assured by our utility that the used nuclear fuel bundles will be quite secure at nuclear stations (in their water filled pools and dry cement canisters) for several decades or more. Meanwhile, massive amounts of uranium mine tailings remain exposed to wind and water erosion. Ironically, most people don't even know that uranium tailings exist, and these pose a very serious and immediate threat to our environment. It leaves little doubt why this particular Environmental Assessment Review Process goes on -- despite a concerted effort by environmentalists from across Canada to have the most pressing issues dealt with first.

In June 1989, Mr. Epp, the Minister of Energy Mines and Resources, spoke to the annual conference of the Canadian Nuclear Association in Ottawa and said that this process is "proof of the government's desire to address fully the public's concerns about this issue". Unfortunately, under the current Terms of Reference, the process is nothing more than proof of the government's commitment to solving one of the nuclear industry's biggest public relations headaches. There are too many relevant issues which we are not being allowed to address, including the fundamental option of not producing any more wastes -- commonly known as "reduction at source" in waste management circles.

The government wants to investigate a concept for burial of nuclear wastes without investigating an actual site. Not only does this severely limit meaningful discussion about the scientific evidence, but this approval in principle, if granted, will allow AECL to claim that the high level waste problem has been solved, without ever having found a community to take these wastes. As you are probably aware, AECL has commissioned polls that reveal that most Canadians are opposed to having a high level nuclear waste dump in their area, even once the method of disposal has been "proven safe". The high level nuclear waste disposal problem is one of the main stumbling blocks stopping public acceptance of nuclear power. What guarantees do you have that this "concept" assessment, if it does proceed, will be followed promptly by a site selection process? AECL insists that nuclear wastes are nothing but a public relations problem. How can the Panel be assured that AECL is capable of being objective about their "concept" of deep geological disposal? It is our opinion that AECL should not have been given the job of solving the nuclear waste problem, since the future of their industry may depend on the outcome of this process. An independent agency must be given this responsibility from now on.

We urge the Panel members to recommend that the Federal Environmental Assessment Review Office request that AECL withdraw their proposal. The effort and resources which, in our view, are being wasted on this Review of AECL's "concept", should be spent on:

- \* cleaning up the uranium mine tailings and historic radioactive wastes scattered in various locations across the country, thereby addressing a more immediate environmental problem, and

- \* developing an environmentally appropriate energy policy, thereby stopping the production of additional radioactive wastes -- the source of the problem.

I look forward to hearing the reply of Panel members to our concerns, raised initially at the scoping session in Oshawa, and reiterated here.

Sincerely,



Irene Kock

c.c. Mr. Epp, Minister of Energy, Mines and Resources  
Mr. Charest, Minister of the Environment









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## **NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT REVIEW OF FEARO PANEL GUIDELINES**

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### **1.0 INTRODUCTION**

This is a review of the Environmental Assessment Panel's draft guidelines of June, 1991, (the "Guidelines") for the preparation of an environmental impact statement ("EIS") on the Nuclear Fuel Waste Management and Disposal Concept (the "Concept") to be prepared by the proponent, Atomic Energy of Canada Limited ("AECL"). The purpose of of this review is to assess the adequacy of socio-economic considerations in the Guidelines. In order to assess the adequacy of the socio-economic considerations it is also necessary to comment on the format of the Guidelines. Since the Guidelines will be used to structure the EIS, they must be in a format that will explicitly mandate that socio-economic considerations be taken into account at each stage of the investigation.

The Guidelines contain most of the elements for a sound environmental assessment ("EA") of the Concept but they do not appear to follow the typical EA format. The purpose of an EA is to demonstrate that a sound planning process has been used to reach an environmentally satisfactory decision. This EA is different from most in that it is an assessment of a concept rather than a specific facility. The satisfactory decision that must be demonstrated here is environmental acceptability of the Concept, as well as the strategy for the site selection process.<sup>1</sup> The Guidelines, as presently designed, do not call for an EIS in a format that will clearly demonstrate how an environmentally sound decision was reached on the Concept.

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<sup>1</sup> It is not clear whether or not a further EA will be conducted of the preferred site. This review assumes that a further EA review is required for site selection.

September 16, 1991

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The Guidelines could be reorganized into three parts to more clearly reflect an EA process, such as below:

- the identification of the Concept;
- assessment of the Concept (irretrievable burial in the Canadian Shield); and
- the site selection process.

Socio-economic issues should be clearly identified and addressed at each stage of the study. Public consultation activities undertaken by the proponent, concerns raised by the public and proponent's responses should also be described in the Guidelines for each stage of the study. This review will discuss the format of the Guidelines for each of these three parts. Socio-economic considerations which may be appropriate for each part will be identified. Recommendations on public consultation are also provided.



## **2.0 THE IDENTIFICATION OF THE CONCEPT**

The Guidelines should require that the proponent describe how and why the Concept was chosen. This should include a description of the problem and the alternative means for addressing the problem (alternatives to irretrievable burial and irretrievable burial alternatives).

As presently organized, following a brief introduction and summary, Section 2 of the Guidelines call for a discussion of the overall problem of nuclear fuel waste management in Canada. While this is a logical starting point, it is followed in Section 3 by a detailed description of the Concept itself. A description of the alternative means available to address the problem would more logically follow the discussion of the problem. In this way it would be made clear to the reader that the Terms of Reference have been met and the various approaches to long term storage of nuclear fuel wastes have been considered. It would also demonstrate that, of all the reasonable alternatives, the irretrievable burial Concept was the preferred alternative.

As the Guidelines are presently structured the alternative means of addressing the problem are not discussed until Section 6. This format may give the reader the impression that the preferred solution was adopted without a consideration of all reasonable alternatives and could lead to the conclusion that the EIS is an exercise in project justification rather than an impartial assessment of the nuclear waste management alternatives. It appears that the process which the proponent has followed has been directed, to a certain extent, by Federal and Ontario government policies. If this is the case, it should be explicitly set out in the EIS as it would assist the reader in understanding the planning process which has been used.

Section 6, "Alternatives to Irretrievable Burial" also should be broadened to include a discussion of the Concept in the same level of detail as the discussion of the other alternatives to permit comparison and evaluation of the alternatives. Socio-economic criteria relevant to alternatives to irretrievable burial should be included. Types of

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socio-economic criteria which may be relevant are:

- characteristics of project at research/construction/operation/closure/post-closure stages
- workforce requirements (numbers, project schedule, secondary business growth)
- infrastructure needed
- need for and utilization of resources
- health - physical and psychological impacts
- technology - perceived and actual impacts
- emergency measures
- transportation/access

Rationale for the criteria should be given and the criteria should be weighted and evaluated as appropriate. Then, the results of the evaluation should be presented and the preferred alternative (irretrievable burial) identified. Section 3.32 "Rationale for Irretrievable Burial" could be incorporated into this section.

The next item which should be discussed is the irretrievable burial alternatives. It is presently Section 3.4 in the Guidelines. As discussed in the previous paragraph, it should include a discussion of the socio-economic criteria to be used and the rationale for the selection of the criteria. (The types of socio-economic criteria to be used will likely be the same as those listed in the previous paragraph.). Once identified, the criteria should again be weighted and evaluated. The results should then be presented and the preferred irretrievable burial alternative identified.

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### **3.0 ASSESSMENT OF THE CONCEPT**

Once the alternatives have been considered and the preferred alternative identified, a detailed assessment should be conducted of the Concept. Socio-economic considerations appropriate to this level of study should be clearly identified and evaluated. The Guidelines currently require that some socio-economic data be taken into account. Suggestions regarding additional socio-economic considerations which may be relevant are provided.

The Guidelines currently require the proponent to present a detailed discussion of the Concept. Since the assessment of the Concept is not site-specific the Guidelines also request a characterization of an ideal site, a discussion of the baseline environment of a suitable site, and a description of the potential impacts on this suitable site. It is these sections of the Guidelines which will be reviewed.

### **3.1 DESCRIPTION OF THE CONCEPT**

Section 3.1 of the Guidelines discusses the capability of the Concept to address the need for the Concept and the risks to the health of the human and natural environments which may be incurred with the Concept. It calls for a discussion of the distribution of risk incurred by current management practices versus that which would be incurred by the Concept. The Section should request that the criteria to be used in this comparison be explicitly set out so the reader will understand the basis upon which the comparison is being made and will be able to follow the decision making process. Social criteria such as perceived risks of leakage, contamination of underground environment, etc. should be included.

Consideration might be given to discussing this section after, rather than before, Section 3.2, "Description of the Concept"

Section 3.33 "Criteria and Assumptions" requests that the proponent outline criteria and assumptions used during the development of its Concept. A request for a description of the rationale used in selecting the criteria should also be included.



Section 3.7 "Facility Construction, Operation and Decommissioning" Section 3.8 "Transportation" and Section 3.9 "Cost Analysis" continue the description of the concept requested in Sections 3.3 to 3.5. Logically Sections 3.7 to 3.9 should follow Sections 3.3 to 3.5. These sections also provide information which could be drawn upon in the sections dealing with site characterization (S. 3.6), impacts on the environment (S. 5) and site selection (S. 7).

### **3.2 SITE CHARACTERIZATION AND BASELINE ENVIRONMENT**

Section 3.6 "Site Characterization" provides a good introduction to the site characterization process. However, the Guidelines should require the proponent to demonstrate a capability for identifying actual candidate sites, in addition to investigating and characterizing such sites. Generic requirements for acceptability of sites (and the rationale for these requirements) should be set out in addition to the unambiguous criteria referred to. Criteria and rationale for the criteria should be provided for each requirement.

The section also provides that the proponent should define an ideal site, the likelihood of finding such a site and procedures for ranking sites, including involving the public in these procedures. No specifics are given in this section or the subsections which follow as to how this is to be achieved. No direction is given for how the criteria for defining an ideal site are identified, how potential sites are to be identified, and how the public is to be involved.

Section 3.61 "Natural Environment" and Section 3.62 "Human Environment" request valuable information which could be used in the site selection process. For instance, they call for criteria for acceptance of candidate sites. The sections are very summary, however. Specifics as to what is to be included in the characterization of an ideal site should be included. This section could be combined with Section 4 "Baseline Environment" which requests this type of information in a much more specific fashion.

In addition to a requirement for criteria and the hierarchy in which the criteria are applied in these sections, a request for rationale for the criteria should also be included.

Section 4 "Baseline Environment" requires the proponent to discuss the natural and human environment that would be suitable for siting the Concept and explain the strategy for investigating the baseline environment. This information would be particularly useful in defining the ideal site as discussed in Section 3.6. It would also be very useful in establishing criteria for an acceptable site to be used in the site selection process.

Section 4.25 "Land Use" could be expanded to include Indian Reserves. Special considerations apply to lands that are subject to the provisions of the Indian Act. The section also could be expanded to include Crown leases and licences (eg. mining companies, cottagers).

Section 4.26 "Infrastructure" may be expanded to include political structures such as municipal, regional and First Nation governments, Tribal Councils, etc.

In addition to Section 4.27 "Lifestyle" use and enjoyment of property, ways of life of resident populations, traditional activities of Aboriginal and non-Aboriginal populations, community cohesion, and social stability could be included.

Since the Concept is evaluating siting the facility in the Canadian Shield, socio-economic factors which are particularly relevant to that environment should be considered. Factors which may be considered are:

**Recreation**

- Recreational use - fishing, hunting, trapping, gathering, snowmobiling, skiing, canoeing, camping, picnicking, touring/sightseeing;

**Economic**

- Aboriginal and non-Aboriginal economic activities including forest resource harvesting, , fisheries, trapping, outfitting, mining, hydro-electric, gathering, tourism. The discussion of these activities should

include access and transportation, anticipated changes without Concept, future potential for expansion without Concept; and

**Social/Cultural**

- Cultural or social aspects of activities such as wood cutting, fishing, hunting, gathering, trapping to both the Aboriginal and non-Aboriginal population.

**3.3 IMPACTS ON THE ENVIRONMENT**

Section 5 "Impacts on the Environment" requires the proponent to describe impacts resulting from normal and accident scenarios on a conceptual environment. It is similar to the previous section on the baseline environment in that it would be useful in defining the ideal site as discussed in Section 3.6 and in establishing criteria for an acceptable site to be used in the site selection process.

Section 5.2 "Impacts on Human Environment" discusses public consultation methods with regard to mitigation. Public consultation methods should be discussed for all aspects of the proposal.

Section 5.25 "Land Use" should be expanded to include impacts on land use trends, valued areas, traditional land uses, aboriginal views on land uses, Aboriginal land claims, Indian Reserve lands, and Crown leases and licences.

Section 5.27 "Lifestyle" could be expanded to include the impacts on use and enjoyment of property, ways of life of resident populations, traditional activities of Aboriginal and non-Aboriginal populations, community cohesion, and social stability.

As was noted with regard to Section 4 "Baseline Environment" the Concept proposes to site the facility somewhere in the Canadian Shield. Potential areas of impact, which may be particularly relevant to the Canadian Shield could be considered:

**Recreation**

- Impacts on recreational use - fishing, hunting, trapping, gathering, snowmobiling, skiing, canoeing, camping, picnicking,



touring/sightseeing;

**Economic**

- Impacts on Aboriginal and non-Aboriginal economic activities including forest resource harvesting, fisheries, trapping, outfitting, mining, hydro-electric, gathering, tourism. The discussion of these activities should include access and transportation, anticipated changes without Concept, future potential for expansion without Concept; and

**Social/Cultural**

- Impacts on cultural or social aspects of activities such as wood cutting, fishing, hunting, gathering, and trapping.

#### 4.0 SITE SELECTION

The description of the site selection process in Section 7 is minimal. Earlier sections require that the proponent provide valuable information which may be used in the site selection process. In those sections the proponent is asked to characterize an ideal site (S. 3.6) , define the baseline environment suitable for siting the Concept (S. 4), and describe generic impacts from the Concept (S. 5). However, it is unclear how the proponent will be required to use this information in identifying a preferred site for the Concept.

The Guidelines should clearly outline a process to be followed by the proponent in developing a site selection strategy. For instance, the Guidelines could require the proponent to divide the site selection process into phases as is done for waste management master plans. The following phases could be used:

- identification of potential sites;
- evaluation of a short list of sites;
- identification of preferred site; and
- preferred site assessment.

The site selection process would include an investigation of access and transportation routes during each phase.

For each phase the Guidelines should require that socio-economic criteria be identified and that the rationale for the criteria be explicitly provided. The criteria should be relevant to the level of investigation being undertaken. The potential sites should be evaluated based on these criteria and the results of the evaluation should be apparent in the EIS. Following is list of socio-economic criteria which may be relevant to each phase of the site selection process.

##### Identification of potential sites

- population concentrations
- Indian Reserves, land claims
- federal and provincial parks, conservation areas
- community acceptability

Evaluation of short list of sites and identification of the preferred site

- displacement/disruption of community, recreation, and tourist features
- displacement/disruption of residents
- population concentrations
- social stability/cohesion
- community character
- social equity
- major economic sectors
- community acceptability

Preferred site assessment

## 1. Recreation

- fishing, hunting, trapping, gathering, snowmobiling, skiing, canoeing, camping, picnicking, touring/sightseeing
- displacement/disruption of community, recreation, and tourist features

## 2. Economic

- Aboriginal and non-Aboriginal forest resource harvesting, other harvesting, fisheries, trapping, outfitting, mining, hydro-electric, and tourism activities including a consideration of access and transportation, physical and psychological well being of workers, transportation routes
- influx of workers during construction and operations
- boom and bust scenario
- employment opportunities
- property values

## 3. Social/Cultural

- displacement/disruption of residents
- social stability/cohesion
- community character
- stress
- satisfaction with community
- local acceptance
- influx of workers during construction and operations
- cultural or social aspects of activities such as wood cutting, fishing, hunting, gathering, and trapping

## 4. Health and Safety



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Tables 6.2 and 6.3 (attached) which have been reproduced from Nuclear Waste: Socioeconomic Dimensions of Long-Term Storage (S.H. Murdock, F.L. Leistritz, and R.R. Hamm, eds.) also provides a list of socio-economic considerations which may be relevant to the site selection process.

The Guidelines are not clear as to whether a further EA review is required for the site selection process, although it is assumed that this is the case. The Guidelines should expressly state that a further EA is required if that is the expectation.

Standard Impacts

<u>Economic/Business</u>	<u>Community Services</u>
Increased local employment	Demand for more services
Higher wages	Demand for better service
Increased business sales	Quality and accessibility
Higher cost of living	Demand for more and spe-
Competition for labor	cially trained personnel
Development of new business	Improvement of service
Increased competition for	facilities and equipment
resources	Higher costs for services
possible economic losses after	Improvement of area road
the repository closes	and rail systems
Increased land values caused	Increased demand for
by growth	housing
Changes in uses of land	

Demographic

Increased population due to  
new workers and families  
Changes in the location of  
population growth  
Changes in the age, income,  
and educational character-  
istics of the population

Fiscal/Government

Additional sales tax  
revenues  
Increased governmental  
payments to communities  
Increased property taxes  
Increased cost of community  
services  
Reassessment of property  
values  
Jurisdictional inequities  
Cost and revenue timing

Source: Adapted from S. H. Murdock and F. L.  
Leistritz, 1979.

Table 6.3

Possible Special Socioeconomic  
Impacts of Repository Siting

<u>Economic/Business</u>	<u>Special Impacts</u>	<u>Community Services</u>
Changes in federal land use-- loss of agricultural, forest or recreational land Competition for water resources--agricultural vs. residential and repository use	Special need for emergency preparedness plans Need for special health care personnel and facilities to treat possible exposure to nearby radioactive materials	
Possible lack of secondary business growth Reduction of adjacent land values Restricted use of adjacent land	<u>Social</u> Perceptions of health and safety risks from nearby radioactive materials Perceptions of lack of equity in the site selection process Increased apprehension of residents Concern with security, long- term safety, and poten- tial danger to future generations	
<u>Demographic</u> Lack of secondary population growth Outmigration of temporary specialized labor Possible outmigration of resi- dents caused by perceptions of changes in the quality of life		
<u>Fiscal/Government</u> Additional costs associated with the transportation of nuclear materials Federal ownership of reposi- tory site, exempting facility from local property tax Loss of tax revenues from agricultural and forest resources produced on federal land Land value depreciation		

Source: Adapted from S. H. Murdock and F. L. Leistritz, 1980.

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### **5.0 PUBLIC CONSULTATION**

Public consultation activities should be discussed by the proponent at each stage of the investigation, including the assessment of alternatives to retrievable burial, irretrievable burial alternatives, and all phases of the site selection process. Public consultation has been discussed in the Guidelines but it has not been a systematic discussion. For instance, Section 3.31 "History of Concept" requires, in part, an examination of the adequacy of the public consultation process. It might more appropriately request a description of the opportunities provided for, and results of, public consultation activities.

Rather than include public consultation in the discussion on the history of the Concept, a separate section outlining public consultation activities at all stages of the project may be more effective. This section should include not just a description of all public consultation activities but document public concerns and the steps that the proponent has taken to incorporate these concerns into the EIS.







# NORTHWATCH

(201)

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September 16, 1991

Mr. J. Blair Seaborn, Chair  
Nuclear Fuel Waste Disposal Concept  
Federal Environmental Assessment Review Panel  
FEARO  
13th Floor, Fontaine Building  
200 Sacre-Coeur Boulevard  
Hull, Quebec, K1A 0H3

ORIGINAL SENT BY FAX 819 994 1469

Dear Mr. Seaborn :

Re. Draft Guidelines for Environmental Impact Statement on NFWMDC

Please find attached comments provided on behalf of Northwatch with respect to the Draft Guidelines for Environmental Impact Assessment of the Nuclear Fuel Waste Management and Disposal Concept.

In summary, it is our assessment that this review process, as it is currently constituted, does not contain the necessary elements to provide the public with a fair and reasonable assessment of the "concept" for which AECL seeks approval. While the reasons for our conclusion are contained in the attached brief, with some additional comment relevant to the process, they can be summarized as :

1) the narrow Terms of Reference, and the Panel's interpretation and application of that narrowness, do not provide for a review which gives adequate consideration to the need for the activity, or of the effects of the activity.



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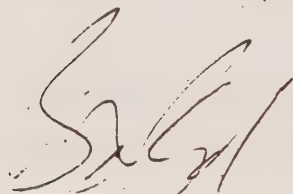
2) the Review, in fact, as it has been accepted by the Panel, does not apply to an activity at all, but rather to an idea about an activity, and as such does not require or provide an adequate level of information or consideration.

3) while spanning more than a decade to date, and demanding considerable resources, the Review fails to address the more pressing matters with respect to the nuclear fuel chain and nuclear (waste) production : the existence of hundreds of millions of tonnes of low-level radioactive waste, which is being ignored and overlooked by the federal government and the nuclear industries, at great expense in terms of environmental and human health, both at present and in the future; the need for a comprehensive energy policy which will place all management decisions in a context of environmentally and economic sound energy delivery.

We are asking you to urge the federal government to halt this Review, and have AECL withdraw their "concept", until such time as other matters are resolved, and AECL is prepared to proceed with a broad and reasonable review. We further encourage you and your colleagues to resign from the Panel should the federal government fail to take appropriate action.

Thank you for your attention and action to this end.

Sincerely,



Brennain Lloyd

Northwatch group liaison

cc. Hon. Jean Charest  
Hon. Jake Epp  
Hon. Ruth Grier  
Hon. Will Ferguson

**Comments to the  
Environmental Assessment Panel with Respect to the  
Draft  
Environmental Impact Assessment Guidelines**

**The Nuclear Fuels Waste Management and Disposal  
Concept**

Submitted by Brennain Lloyd, on behalf of Northwatch  
September 16, 1991

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## A. THE AECL APPROVAL PROCESS : TO DATE

This process, in the broader sense of its development, is now fourteen years old. Through a succession of governments and political leaderships, it has been carried along, with AECL (more or less firmly) at the helm. To the degree that anyone is at the helm at all. What AECL is seeking is approval. Period. Approval for their continued activities, most notably the (somewhat stalled) expansion of the nuclear industry, and central to that, the continued construction and operation of nuclear reactors, with resultant continued production of the high level radioactive waste. For the last fourteen years, this has been carried forward in a policy vacuum, with regard from both proponent and regulators for only what AECL has described as a "public relations problem" - the disposal of the high level radioactive waste - as a major stumbling block.

No one can accuse AECL of not being flexible - they tried finding a site, and when that didn't work, they were flexible enough to switch horses and now seek approval of a "concept". And they are willing to be flexible about the "concept" as well - it could require burial at 500 feet, or it could be one thousand; it could involve fuel reprocessing, but it may not; it might require one container for transport and burial, but it may be better with two; it will likely be "irretrievable", but that may change as well. The one point they are not willing to give up is their desire for "approval". It may require millions of dollars, and decades of public relations work, and cost the public the integrity of its environmental assessment process, but we can only presume that, in the eyes of AECL and their nuclear cohorts, it is all worth it, for it will mean they can continue to produce increasing quantities of high level radioactive waste with one major stumbling block removed.

Ten years after Canada and Ontario announced a program of research and development to investigate burying high level radioactive waste in granite, and seven years after the governments of Ontario and Canada jointly announced a process for evaluation of the "disposal" concept, Energy Minister Marcel Masse referred "the specific concept of deep geological disposal of nuclear fuel wastes" to his colleague Environment Minister Tom McMillan, for an Environmental Assessment and Review, suggesting the basis of the terms of reference for the review in his letter of referral. Public interest groups requested meetings and opportunities to discuss the terms of reference in advance of their formulation and release, and were refused; they submitted "draft" terms of reference, and were ignored. The terms of reference for the eventual Federal Environmental Assessment and Review, designed and delivered without opportunities for public input, were restrictive in the extreme, and have been subject to much and repeated criticism since their release.

The hearing process itself, since the establishment of the Panel, has itself been very badly flawed, to the point where public interest groups must seriously question any continued involvement or association - some have already withdrawn, and the Panel must act in the interests of correcting the process if it is not to be left wholly bereft of participants. But then, many ask : if first we have an environmental assessment without an environment, why not a public review without a public?

Specifically, the last year of the hearing process has been plagued by unreasonably short time lines which have seriously handicapped public involvement; inadequate public notice is given by the FEARO office to the public with respect to the hearing process, thereby limiting even the potential for public involvement; and inconsistent information has been provided by FEARO staff with respect to the process. Further, public interest groups have been advised that they may communicate with Panel members \_only\_ via FEARO staff. Also, conditions were placed on the granting of intervenor funding which disallowed the use of any funds for the procurement of legal advice in preparing for the scoping meetings, even in extremely limited amounts. The very far reaching implications of the proposal under review, coupled with the extremely limited terms of reference, raise a number of interesting and relevant legal and constitutional questions, and the specific disallowance of legal advice is a further limit to public access and information with respect to this review.

A general sense of "hit and miss" pervades this hearing process : FEARO staff turnovers; Panel chair turnovers; ever-changing time-lines; companion reviews which are promised, appear, and then disappear; denial of legal advice; questioned credibility of Review members; and the ever-twinning of the proponent and the reviewer, all contribute to a sense of "kangaroo court" which the Panel must now work diligently to dispel.

## B. THE BASIS FOR PROCEEDING

The Guidelines Order (SIR/84-467 22 June, 1984) state clearly that "a public review shall include ... an examination of the environmental effects of the proposal; and ... an examination of the directly related social impact of those effects."

### 1. THE INTEGRITY OF PROCESS

The exclusion of a site makes this an environmental assessment without an environment, which raises questions of legality with respect to the process. The Guidelines Order (SIR/84-467 22 June, 1984) state clearly that "a public review shall include ... an examination of the environmental effects of the proposal; and ... an examination of the directly related social impact of those effects.", both of which are literally impossible in the absence of any consideration of site, as AECL is currently proposing the Review be done. The most reasonable course for the Panel, at this point, would be to refer the Review back to the Minister, with the advice that a review cannot be done until the project is a describable one, ie. one that includes a physical environment. A less satisfactory alternative would be to : 1) require the proponent to prepare "case studies" of a range of representative sites (for example, each ecological zone which may be subject to a site-specific assessment), demonstrating the supposed feasibility of the proposal in the context of an actual environment, or rather in a range of actual environments, since no specific site is being assessed or proposed; and 2) require in the decision, should the Panel's decision potentially result in future site-specific assessments (ie. approval or part-approval), that a full review be provided for any site-specific proposals, including an examination of questions of need, alternatives, costs and benefits, and biophysical impacts for all extents of the activities



## 2. THE PARTICIPATION OF ONTARIO

"In June 1978, the governments of Canada and Ontario announced a program of research and development to assess whether permanent disposal in a deep underground repository in intrusive igneous rock is a safe, secure and desirable method of disposing of nuclear fuel wastes. Since 1978, as directed by the Government of Canada, AECL has been pursuing a research program on the immobilization and disposal of nuclear fuel wastes. Ontario Hydro has supported AECL's work and pursued its own related studies on interim storage and transportation of used nuclear fuel.

"In August 1981, the governments of Canada and Ontario jointly announced a process for the evaluation of the disposal concept. It was agreed then that no site selection of a permanent disposal facility would be undertaken until the concept had undergone a public review and had been accepted by both governments."

In the terms of reference, cited above, the hearing process is being cleared described as a joint one, involving the Governments of both Ontario and Canada. Yet, to date, the hearing process has been a unilateral one, conducted by the federal government, according to a (weak) interpretation of their standards and methods of environmental assessment. The Province of Ontario has been an invisible partner, if a partner at all. The hearing process should now become a joint one, with the standards of the Ontario Environmental Assessment Act and its processes in place and in effect, and the Province having joint and equal authority, exercised by the Minister.

### 3. THE TERMS OF REFERENCE : INTERPRETATION OR AMENDMENT

While the published terms of reference exclude considerations of site, and, "the energy policies of Canada and the provinces; the role of nuclear energy within these policies ...; fuel reprocessing as and energy policy; and military applications of nuclear technology", the task of the Panel is to interpret those terms of reference, particularly in view of the Guidelines Order, and ensure that the requirements of a public hearing are met. It was, as was pointed out to the Panel during the Scoping sessions in 1990, the Panel's prerogative to exceed the parameters initially set out (the example cited was the instance of the Environmental Assessment Review Process of the "Military Flying Activities in Labrador and Quebec" (January, 1987), wherein the letter of referral stated "Canada's defence policy would not properly be within the scope", and yet the E.I.S. Guidelines required that a section be included containing "project justification", that would "describe the purposes of the Project and how it fits into international, national and regional treaties, plans, agreements, strategies, or requirements"), by providing specific direction to the proponent in the Environmental Impact Statement Guidelines. While the Panel may choose to not frame the direction as "discussion of energy policies", at minimum it must require a description and discussion of those activities which will flow directly from the proposal : in the instance of seeking and gaining approval of a method of high level radioactive waste "disposal", one of the relevant results of such and approval would be the encouragement of continued nuclear waste production. As such, the entire nuclear fuel change should be the subject of this Hearing Process, with a full discussion of the need, alternatives, costs and benefits of each aspect of the nuclear fuel chain integrated into the Panel's considerations.

#### 4. ENERGY POLICIES : THE "PROMISED" REVIEW

In earlier stages of the Federal Environmental Assessment of Nuclear Fuel Waste the federal Department of Energy Mines and Resources (EMR) made a commitment to conduct a broad review of Canada's energy policies, in response to criticisms of the FEARO terms of reference.

October 25, a letter was sent from Bruce Howe, the Deputy Minister of EMR to the provincial governments, industry groups and associations, and a selected list of environmental organizations, announcing that "a joint ministerial task force on environmental impacts of different technologies for generating electricity" was to be appointed. The letter asked the recipients to comment on the proposed terms of reference, which were enclosed.

Those commenting made a number of recurring recommendations, including the postponement of the Federal Environmental Assessment of Nuclear Fuel Waste Management and Disposal until the completion of the EMR Public Review of Electricity and the Environment; a shifting of the emphasis of the Electricity Review to focus on energy-use reduction and on the potential for energy efficiency and energy conservation; and a re-issuing of proposed terms of reference for the Public Review of Electricity and the Environment, with a four month period for public response, and with much broader consultation.

April 17, the deputy Minister of Energy Mines and Resources informed the public that the Review had been deferred, it appears indefinitely, to allow other energy-related tribunals and reviews to proceed in advance. Minister of Energy Jade Esp advised Mr. Lair Seaborne, chair of the FEARO Panel on NWFMDC of the delay, acknowledging that the Panel had received a commitment from the federal government to conduct the Electricity and the Environment Review as "a complement" to the FEARO of NWFMDC.

The Panel should now take action to postpone the FEARO on NWFMDC until such time as a broad review takes place, either within their own considerations, or in a "complementary" review, as had been committed. To proceed now, in absence of the "complementary" review, is unthinkable.



## C. CRITIQUE OF THE DRAFT GUIDELINES FOR THE PREPARATION OF THE ENVIRONMENTAL IMPACT STATEMENT

### i. Introduction :

- see remarks re. terms of reference and scope of NWFMDC FEARO; integrity of environmental review process; and joint nature of review and decision-making; in sections A, and B of this document.
- the EIS summary and main document should also be available in Cree, Ojibway and Ojicree

### 1. SUMMARY :

- see remarks re. terms of reference and scope of NWFMDC FEARO; integrity of environmental review process; and joint nature of review and decision-making; in sections A, B of this document

### 2. NUCLEAR FUEL WASTE - THE PROBLEM

- see remarks re. terms of reference and scope of NWFMDC FEARO; integrity of environmental review process; and joint nature of review and decision-making; in sections A, B of this document
- the description of nuclear fuel waste should include detailed description of each of the contained radioactive isotopes, their half-lives, and known, possible or suspected affects on life forms, including human, at a range of exposure levels, varying from constant high "dose" to short-term low "dose". The description should be given for each radioactive isotope individually, and for all variable combinations of isotopes, and should include estimates of volume, basis for those estimates, and calculation of remaining volumes of each isotope, at 100 year intervals, until the volume is reduced to a quantity whereby ingestion would have no adverse health effects.

- the past performance of nuclear waste practices in other countries, including Canada, the U.S., France, the U.K., and Sweden should be fully described and explained, individually and in reference to the AECL "concept"

### 3. THE AECL CONCEPT

- see remarks re. terms of reference and scope of NWFMDC FEARO; integrity of environmental review process; and joint nature of review and decision-making; in sections A, B of this document
- in describing the history of the AECL "concept", and its development, a full account of AECL's investigation of potential sites, its' communication with, relationship to, and the reaction from, each

## D. SPECIFIC INPUT TO THE E.I.S. GUIDELINES

The following points for inclusion in the E.I.S. Guidelines have been previously provided to the Panel, and have been largely if not wholly ignored. In a general sense, the draft guidelines were grossly lacking in detail and specific direction, and as such are expected to be gravely inadequate to the task of exacting from the proponent an adequately detailed description of the project on which a public hearing and decision may be based.

The following areas should be clearly described, in detail, in the Environmental Impact Statement:

### 1. Option Selection:

- i) Describe other options investigated for the disposal of spent nuclear fuel waste.
- ii) Describe the rationale for selecting the deep-rock disposal method over the other investigated options.
- iii) Describe the decision-making and public consultation process used to reach that decision.
- iv) Describe other geological medias investigated as "host" rock for the deep-rock disposal of spent nuclear fuel waste.
- v) Describe the research steps which concluded in intrusive igneous being the preferred rock form, of those investigated.

### 2. Filling Methods:

- i) Describe other materials investigated for use as filler materials in each of the identified barriers using a filler material ( eg. fuel bundle container, boreholes, disposal rooms, vault)
- ii) Describe the rationale for selecting each particular filler material over other investigated materials.
- iii) Describe the decision-making and process used to reach the decision to select the number of different materials that would be investigated.
- iv) Describe each of the particular filler materials selected (eg. sodium bentonite clay,

silica sand), the characteristics on which the selection was based, the various properties of each filler material.

- v) Describe the source of each selected filler material, the method by which that material is produced or extracted, including a description of the environmental impacts of that production or extraction, and the intended method of import or transportation of that material to the disposal facility.
- vi) Describe any environmental hazards, risks, or consequences that could be associated with the introduction of the various filler materials into the local environment en route or at the disposal facility.

### **3. Containers:**

- i) Describe the method and location of construction of each of the containers to be used in the fuel transport and disposal centre.
- ii) Describe the relationship of cost effectiveness to containment effectiveness in the decision-making process with respect to the construction of containers.
- iii) Describe the source of each material to be used in the container construction, ie. titanium, zirconium, etc.
- iv) Describe how trade or economic embargoes limiting sources of materials used in container fabrication would be accommodated in the implementation of an approved concept of disposal.
- v) Describe the waste management plans for each of the production facilities planned for the disposal centre site, ie. for solid waste, industrial waste, hazardous and chemical waste.
- vi) Describe the barrier qualities of each of the types of container systems to be used, (ie. resistance to corrosion, radiation, heat, time, etc) and describe how those qualities were established as factual, what research was done and what reference was made to other research experiences.

### **4. Transfer and Transport:**

- i) Describe the construction of each transfer site, including the design of each facility, the materials to be used, the containment systems to be utilized, the monitoring systems and methods to be in place, the manner in which the impact on the local environment will be evaluated, and the waste management plans for all forms of resultant waste.



- ii) Describe the selected method of transport, including the design of each the transportation containers, the materials to be used, each of the containment systems to be utilized, the monitoring systems and methods to be in place, the manner in which the impact on the local environment will be evaluated, and the waste management plans for all forms of resultant waste.
- iii) Describe the projected costs of transporting nuclear wastes to a centralized facility, as compared to continued storage at the point of origin.
- iv) Describe the benefits and disbenefits of spent fuel waste being transported in the disposal container, as compared to being transported in a specialized transport container, and transferred at the disposal facility. Discuss the economic, environmental and health considerations that were factored into the decision-making process, and describe how the public was involved in the final decision.

## 5. Monitoring:

- i) Describe the monitoring plans for each transfer of the spent fuel waste, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public.
- ii) Describe the monitoring plans for each stage of transport of the spent fuel waste, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public.
- iii) Describe the monitoring plans for interim storage at the disposal facility, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public.
- iv) Describe the monitoring plans for the underground disposal facility while under construction and during the period of use, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public.
- v) Describe the monitoring plans for the underground disposal facility after construction and following the "period of use", (after the facility is filled), identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public.

- vi) Describe the emergency measures which will be in place to deal with unanticipated levels of release of radiation into the environment.
- vii) Describe the standards which will be used to determine: a) if a release constitutes a danger to the environment or the public; b) what level of danger the release constitutes; c) the perimeter of the area affected.
- viii) Describe the manner and extent of public notice in the event of an unanticipated level of release of radiation into the environment from an interim storage site, transfer site, during transport, or from the disposal facility.
- ix) Describe the relationship of the monitoring or regulatory body(s) to the proponent, and the reporting relationships of the proponent and the monitoring or regulatory body(s) to each other, to the Minister(s) responsible and the public.

## 6. Risk Assessment:

- i) Describe the proponent's definition of "acceptable risk" in terms of allowable exposure to each of the approximately 300 radioactive isotopes contained in spent fuel waste.
- ii) Describe the research, rationale, public consultation, and decision-making that led to the proponent's conclusion of "acceptable risk" at the level described in its definition.
- iii) Specifically, describe the research conducted or relied upon by the proponent in reaching that conclusion, which has been conducted in areas of radiation exposure (in particular areas such as the Marshall Islands, Nevada Test Site, Sellafield, U.K., each of A.E.C.L.'s Canadian facilities, and Elliot Lake).
- iv) Describe the definition of "acceptable risk" ascribed to by other governments, and by national and international health and public interest organizations, and cross-reference those definitions of "acceptable risk" to the proponent's own.

## 7. Siting Process:

- i) Describe the siting process to be used in selecting any transfer station(s) for spent fuel waste, including a itemized description of the impacts to be described in assessment documents for each transfer station (eg. need, alternatives, physical and socio-economic impacts), and the public consultation and decision-making to be used in each instance. Describe, in particular, the decision-making process as it applies to unorganized communities and townships, and to adjacent communities and townships.



- ii) Describe the siting process to be used in selecting any transport route(s) for spent fuel waste, including an itemized description of the impacts to be described in the assessment documents for each transport route (eg. need, alternatives, physical and socio-economic impacts), and the public consultation and decision-making to be used in each instance. Describe, in particular, the decision-making process as it applies to unorganized communities and townships, and to adjacent communities and townships.
- iii) Describe the siting process to be used in selecting any interim storage site(s) for spent fuel waste, including a itemized description of the impacts to be described in assessment documents for each transport route (eg. need, alternatives, physical and socio-economic impacts), and the public consultation and decision-making to be used in each instance. Describe, in particular, the decision-making process as it applies to unorganized communities and townships, and to adjacent communities and townships.
- iv) Describe the siting process that will be used in establishing the disposal facility, including:
  - a) a description of the decision-making process;
  - b) the role of the immediate and adjacent communities;
  - c) the proponent's definition of "affected communities" as it will be used in determining the appropriate model of decision-making;
  - d) the method and rationale for initial selection of potential sites; e) the method and rationale for site-elimination;
  - f) the body or party to be responsible for managing the site selection and decision-making process and its relationship to the proponent;
  - g) the amount and manner of funding that will be provided by the proponent for independent review(s) of the facility proposal by interested or affected parties;
  - h) the decision-making party and method for the allocation of those funds for independent review(s).

## 8. Surface Facilities:

- i) Describe the construction of each of any surface facilities that will be in place at the disposal site, including, and in particular, the construction of any container manufacturing plant, used fuel packaging plant, concrete plant, rock-crushing plant, and disposal vault head frames, with respect to:
  - a) the design of the facility;
  - b) the materials to be used in the construction, including their source, and any environmental impacts associated with the production or extraction of the material



- being described;
- c) the containment systems to be utilized, for any radioactive or non-radioactive hazardous materials;
- d) the monitoring systems and methods to be in place with respect to both radioactive and non-radioactive hazardous materials;
- e) the manner in which the impact on the local environment will be evaluated, including considerations of impact on wildlife, species habitat, flora, fauna, ecosystem integrity, watersheds and adjacent or immediate water bodies, cultural, social or wilderness values.
- f) the anticipated emissions from each of the facilities, the effect of each of those emissions on the environment, the method of monitoring and measuring the emissions from each of the facilities;
- g) the waste management plans for all forms of resultant waste, including solid waste, hazardous waste, rock waste, radioactive waste, industrial waste, and other wastes to be generated.

## 9. Reprocessing:

i) Describe conclusively the proponent's plans with respect to reprocessing spent fuel wastes, ie. an intention to include reprocessing in its fuel waste management proposal, or to not include it. Following that:

a) Should the proponent describe its plan as one that does not include the reprocessing of spent fuel wastes, eliminate all discussions of that option from the consideration of the proposal (Note : this would require any future approval to be conditional on the exclusion of the reprocessing of spent fuel wastes).

b) Should the proponent describe its plan as one that does include the reprocessing of spent fuel waste, include in the description of the proposal the following :

- the rationale for accepting spent fuel waste reprocessing as part of the waste management approach, with reference to international experiences with this method
- the decision-making and public consultation process used to reach that decision
- the monitoring plans for the spent fuel waste reprocessing facility, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public
- the standards that will be used to determine :
  - a) if a release constitutes a danger to the environment or the public,
  - b) what level of danger the release constitutes,
  - c) the perimeter of the area affected
- the manner and extent in which public notice will be given in the event of an unanticipated level of release of radiation into the environment from a reprocessing facility
- the relationship of the monitoring or regulatory body(s) to the proponent, and the

reporting relationships of the proponent and the monitoring or regulatory body(s) to each other and to the Minister(s) responsible and the public.

- the design of the facility;
- the materials to be used in the construction, including their source, and any environmental impacts associated with the production or extraction of the material being described;
- the containment systems to be utilized, for any radioactive or non-radioactive hazardous materials;
- the monitoring systems and methods to be in place with respect to both radioactive and non-radioactive hazardous materials;
- the manner in which the impact on the local environment will be evaluated, including considerations of impact on wildlife, species habitat, flora, fauna, ecosystem integrity, watersheds and adjacent or immediate water bodies, cultural, social or wilderness values.
- the anticipated emissions from each of the facilities, the effect of each of those emissions on the environment, the method of monitoring and measuring the emissions from each of the facilities;
- the waste management plans for all forms of resultant waste, and in particular for liquid high level nuclear waste
- the methods of containment to be utilized with respect to the release of radioactive gasses in the reprocessing
- the emergency measures that will be in place to deal with anticipated or unanticipated levels of release of radiation into the environment.

## 10. Disposal Facility:

i) Describe conclusively the proponent's plans with respect to the construction of the underground disposal facility, including all details of its construction, the geological media, the containment barriers, the research leading to the decisions taken, the public involvement in the decision-making, the supporting experiences internationally, the non-supporting experiences internationally, and the impacts on the physical, socio-economic, and psychological environments for affected communities. In particular, the description should include :

- the rationale for accepting deep rock disposal as part of the waste management approach, with reference to international experiences with this method, and with reference to other available options, such as above-ground containment at the waste source.
- the decision-making and public consultation process used to reach that decision
- the monitoring plans for the facility, identifying the monitoring or regulatory body, the parties required to review the monitoring results, the technical aspects of the monitoring plan, and the plans for making the information available to the public - the standards that will be used to determine :



- a) if a release constitutes a danger to the environment or the public,
- b) what level of danger the release constitutes,
- c) the perimeter of the area affected
  - the manner and extent in which public notice will be given in the event of an unanticipated level of release of radiation into the environment from a reprocessing facility
  - the relationship of the monitoring or regulatory body(s) to the proponent, and the reporting relationships of the proponent and the monitoring or regulatory body(s) to each other and to the Minister(s) responsible and the public.
  - the design of the facility;
  - the materials to be used in the construction, including their source, and any environmental impacts associated with the production or extraction of the material being described;
  - the containment systems to be utilized, for any radioactive or non-radioactive hazardous materials;
  - the impact on the local environment will be evaluated, including considerations of impact on wildlife, species habitat, flora, fauna, ecosystem integrity, watersheds and adjacent or immediate water bodies, cultural, social or wilderness values.
  - a description on the manner in which the impact on the local environment will be evaluated, with consideration to any subjective or cultural value or world-view differences that may affect the manner in which the impacts are assessed or described
  - the anticipated emissions from each of the facilities, the effect of each of those emissions on the environment, the method of monitoring and measuring the emissions from each of the facilities;
  - the waste management plans for all forms of resultant waste, for example of the waste rock resulting from the facilities construction
  - the emergency measures that will be in place to deal with anticipated or unanticipated levels of release of radiation into the environment.
- ii) Describe what consideration has been given to the changing global atmosphere, and how that may potentially affect rock stability in the selected geological media.
- iii) Describe what consideration has been given to the introduction of a significant heat source into the selected geological media, and how that may affect rock stability.
- iv) Describe the water movement patterns in the selected geological media, and the method and extent of research and study undertaken to establish this description.
- v) Define the term "stable" if it is to be used in the Environmental Impact Assessment document.
- vi) Define the term "permanent", if it is to be used in the Environmental Impact Assessment document.



vii) Describe conclusively the proponents plans with respect to the retrievability, or non-retrievability of the waste, and on what basis that plan was selected over other options.

viii) Describe the regions under consideration for the siting of the disposal facility, the manner and rationale for selection of those areas over others, the manner and rationale for the elimination of certain potential areas (ie. southern Ontario), and the public or governmental involvement in the decision-making leading up to the inclusion or exclusion of particular regions.

ix) Describe the bio-physical, social, economic, and cultural features of each of the districts that could be considered as a site for the disposal facility, and the anticipated impacts of the disposal facility with reference to those features.

#### **11. Accumulative Effects of Radiation:**

i) Describe what studies have been done to establish the accumulative effects of radiation resulting from nuclear technology in each of the geographic areas which could be considered as a possible site for the disposal facility, a transfer site, or a transport route.







To John McEwen  
 A Federal Environmental Assessment Review Office  
 Central Region

From Chief, Environmental Assessment Division  
 De Office of Environmental Affairs  
 Energy, Mines and Resources

Date September 17, 1991

Subject Nuclear Fuel Waste Management and Disposal Concept  
 Object Comments on Guidelines for the E.I.S.

Enclosed please find the Department of Energy, Mines and Resources comments on these guidelines. I would like to apologize for our late response, but due to the PSAC strike this was unavoidable. Please note that each of the comments is keyed to the draft guidelines, dated June 1991, by section number. Many comments apply more broadly, however, and should be considered wherever appropriate.

# 1. Introduction

EMR suggests that the mandate of the Panel be stated clearly and up-front in the introductory section in paragraph 6 for the purposes of making clear not only the Panel's mandate but to also state that the Panel's recommendations will assist future governments in reaching decisions to ensure the safe, long-term management of the nuclear fuel wastes in Canada.

Paragraph 6 should read:

"The Panel will consider all of the submissions received during the public hearings in support of its mandate, to undertake a review of Atomic Energy of Canada Limited's (AECL) concept of geologic disposal of nuclear fuel wastes in Canada along with a broad range of nuclear fuel waste management issues. It will examine AECL's proposed concept along with other approaches for nuclear fuel waste disposal being developed elsewhere in the world.

As a result of this review the Panel will make recommendations to Ministers of Environment and of Energy, Mines and Resources to assist them in reaching decisions on the acceptability of the disposal concept and on the steps that must be taken to ensure the safe long-term management of nuclear fuel wastes in Canada."

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## **2. NUCLEAR FUEL WASTE - THE PROBLEM**

In the introduction and/or the problem statement, the EIS should deal with future use/expansion/cutbacks in nuclear power generation, if only to state unequivocally that the issue is beyond the scope of this EIS and the mandate of this panel. The EIS could note that we have a nuclear fuel waste problem NOW, which must be addressed regardless of what happens in the future.

### **2.1 Nature of Nuclear Fuel Waste**

The last sentence in this whole section is incomplete and some text seems to be missing.

### **2.3 The Need for Long-Term Management of Nuclear Fuel Waste - Risks to the Health of Natural and Human Environments**

With respect to the earthquake issues EMR suggests that terminology could be improved. Presently in the guidelines use is made of the term "seismic risk". It is now commonly accepted that the term "seismic hazard" refers to a statement about the effects (faulting, ground shaking, etc.) of the earthquakes, whereas "seismic risk" refers to a statement about the possible consequences resulting from these effects. It would be appropriate for the EIS to distinguish between these two concepts and demonstrate that the "hazards" are well enough understood that they can be accommodated to minimize the "risk".

### **3.33 Criteria and Assumptions**

Is there a need to create a fund, from operating revenues, to provide for the costs of the long term operation of the facility -- a sort of perpetual care endowment?

### **3.5 Isolation of Nuclear Fuel Waste - The Multiple Barrier System**

As far as possible, all aspects of the isolation system should be designed to "fail safe".

Recent problems with the premature failure of nuclear fuel bundle casings and piping in reactor cores have been attributed to the unanticipated "aging" of metals due to the intense radiation levels of their operating environments. What is the implication of this problem for the Concept?

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### 3.512                   The Container System

On page 10 is a clause: "the application of possible natural and other analogs to the container system and its components [must be described]". This present wording is difficult for the general public to understand. EMR recommends humanizing the wording.

On pages 10-11 is a clause: "a statement of the criteria for tolerable deviations from predicted behaviour [must be included]". This should go on to read: "and the response plan, should deviations exceed tolerable limits, should be presented."

### 3.513                   The Vault System

Why is the choice of excavation technology to be described and justified? In this clause the guidelines are straying away from performance criteria and how they should be met, and into the field of accreditation of methods. This would be a mistake because (a) it may limit innovation, and (b) it may move responsibility from the proponent to the regulator or reviewer. Why not request "the criteria for choosing ..."?

### 3.54                   Performance Assessment of the Multiple Barrier System

Would anything useful be gained by requesting sensitivity analyses for the models and plans -- sensitivity to variations in input errors, assumptions, etc.?

### 3.71                   Project Management

Plans should be described for the restoration of control and the resumption of normal operations in the event a major failure in electrical or communications services to the project management information system. Such a failure may be beyond the proponent's power to prevent, and reestablishment of all systems may take several days or even weeks. Should such a failure occur during a critical stage in construction or in waste handling, a fail safe back up is needed. Approaches such as hot sites, cold sites, duplicate systems, etc., should be considered. (Reference recent Treasury Board reports on "Disaster Recovery", See Annex 1.)

### 3.73                   Labour Requirements

The implications of and plans for responses to possible industrial action (strikes) by the labour force should be included, given the nature of the "product" involved in the Concept.

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### 3.81           Transportation Management

The comments under **Project Management** and **Labour Requirements** apply to the matter of Transportation Management, particularly as aspects of transportation will not be under the total control of the Proponent.

### 3.82           Transport Container System

There have recently been published reports of the "sweating" of nuclear fuel waste transport containers and of unexpectedly high levels of radioactivity on the exterior of containers. The cause does not seem to be understood, although acid precipitation has been suggested as a possible factor. The issue needs to be addressed in the EIS, if only because it is likely to be raised by the public.

## 4.            BASELINE ENVIRONMENT

This section addresses only the Site component of the Concept. Baseline environment conditions for the Transportation should also be presented.

### 4.21           Demographics

EMR suggests that the word "race" be replaced by "living habits" if the ultimate goal of the EIS is to ensure that the environment and members of the public are not exposed to any undue risks from the nuclear waste.

### 4.25           Land Use

The general need to protect high quality croplands and foodlands should be considered in the EIS.

## 5.            IMPACTS ON THE ENVIRONMENT

The impacts of the three phases of the proposal -- construction, operation and abandonment -- need to be examined separately. The impacts for each phase must be found to be acceptable before overall approval is given.

Impacts of the Transportation component of the Concept should be addressed separately from those of the site component

.../5

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## 5.24 Economics

It would appear appropriate for the proponent to generally estimate the costs versus the benefits of various methods of disposal of nuclear wastes even though the uncertainties may be significant. Some insightful information may come from such an assessment.

A general comment would be that there appears to be inadequate attention in the EIS Guidelines to quality assurance. There is an apparent misunderstanding that quality assurance means inspection of hardware. There needs to be a system to ensure the quality of the project in all aspects of the work (research, development, analysis, design, manufacture, construction, operation, decommissioning, etc.). While it is expected that the proponent would have such a system in place, this should be a requirement for the EIS. This will demonstrate the quality assurance and safety culture that is being sought by the guidelines.

I wish to thank FEARO for the opportunity to provide comments to this important document. If FEARO or any member of the Panel has any questions regarding EMR's comments please do not hesitate to contact me at 995-3866.



Roy E. Kwiatkowski









Mr. Blair Seaborn

Sept 19, 1991

(228)

Chair, Environmental Assessment Panel

AECL's Nuclear Fuel Waste Management and Disposal Concept  
Fontaine Building, 200 Sacre-Coeur Blvd, 13<sup>th</sup> floor  
Hull, P.Q. K1A0H3

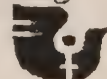
Dear Mr. Seaborn,

NAC appreciates the opportunity to present our assessment of guidelines for the Preparation of an Environmental Impact Statement. As it stands it may be a daunting task for AECL to fulfill fairly as the proponent.

Enclosed is the "Overview" prepared by Anne Lindsey, NAC's presenter at the scoping hearings in Winnipeg in November, 1990. We concur with her report.

We comment the observations on Pages 3 and 4, 2.2, the first two paragraphs. Compiling the history of nuclear waste management should be even more valuable if expanded to would experience. Failures because of human ignorance or carelessness with this unforgiving technology have left a legacy of lethal waste beyond Canada from uranium mining and abandoned nuclear stations. The highly radioactive remains of the reactor at Chernobyl, destroyed in 1986, must also be considered "nuclear fuel waste" and relevant to this examination. Its burial sarcophagus has already developed large cracks frequented by birds, and requires further entombment with additional risks to the environment.

Regretfully, this Panel's mandate specifically excludes looking to Canada's future energy policy, a point deplored by many who have appeared before you. Still, regardless of the Panel's final recommendation on this concept of waste management, pursuit of the information suggested





Could nevertheless gather valuable information for Canada's emerging energy policy. We cannot allow ourselves to be maneuvered into bequeathing impossible monitoring and maintenance tasks to future generations.

Alternatives are necessary. The logical one is adoption of an energy policy that facilitates electricity from renewable solar, wind, tidal and thermal sources, together with vigorous conservation and greater efficiency, we could make a real contribution to our own and our planet's health and survival, gradually freeing ourselves from the increasing menace of nuclear power generation.

Sincerely  
 Betsy Carr  
 Member, NAC Survival of the Planet  
 Committee

CC. Mr. J. Epps  
 Minister of Energy  
 Mr. J. Charest  
 Minister of the Environment

COMMENTS ON THE GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT ON AECL'S NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT.

The National Action Committee on the Status of Women

Overview

When then Minister of Energy, the Honourable Marcel Masse, announced the Environmental Assessment Review of AECL's nuclear waste disposal concept in 1988, he said that this EARP would be "one of the most important environmental assessments ever undertaken in this country and will provide an essential foundation for future decisions on energy policy". However, the terms of reference issued to the review panel did not reflect a similar emphasis. In fact, they explicitly excluded consideration of the impacts of the concept on Canada's energy policy.

Many participants at the scoping sessions, including NAC, insisted that these impacts are an absolutely necessary and fundamental component of the review, especially as they relate to the future development of the nuclear power industry in Canada. In spite of this very clear expression of public sentiment, consideration of energy impacts does not appear in the EIS Guidelines.

This omission is a major flaw in the Guidelines document.

The Guidelines approach the question (at 2.1) by asking what impacts future changes in energy policy will have on the nature and characteristics of nuclear fuel waste, but to be meaningful they must also ask specifically about the impacts of approving a technology for the disposal of nuclear waste on the industry which produces the waste.

Also in 2.1, the Guidelines ask about the impacts of changes in nuclear technology. Presumably, this would include the potential development and implementation of reprocessing technology. If this is indeed the case, then reprocessing should be specifically named, and the impacts of reprocessing technology fully examined. The question of reprocessing should not be "grandfathered" into this review without full assessment.

A final consideration in this overview arises from Sections 4 and 5: Baseline Environment and Impacts on the Environment. Both of these sections begin "Since a site has not been identified at this stage of the Concept development,...."

The Guidelines request that AECL prepare a "study strategy" to explain how the baseline environment and impacts on the environment may be examined. These sections prove most clearly that this review is not an Environmental Impact Assessment in the usual sense of the term. The only thing that a "Study Strategy"



might illuminate is AECL's ability to plan and carry out an EIA. In no way could it claim to determine either environmental or social acceptability of the disposal of nuclear waste. It seems reasonable enough to suggest that FEARO is not the proper agency to be overseeing this study strategy. In fact, a University Graduate Program in Environmental Studies might be a more appropriate supervisor, at considerably less expense to the taxpayer.

NAC and many other participants in the scoping hearing were clear that environmental and social impacts cannot be properly determined in the absence of an environment. Any judgement by the Panel on acceptability of nuclear waste disposal based on a "study strategy" will correctly be seen to be hollow and meaningless.

#### General comments.

p.2: para.6. Since much of the land proposed as potential repository sites is subject to aboriginal land claims, EIS Summary and Main document should be translated into aboriginal languages as well as English and French.

p.3: para.3. 2.1 It is unclear what is meant by "the nuclear fuel cycle", in this context. NAC considers all wastes and effluents produced at any point in the nuclear fuel chain to be part of the "Nuclear Fuel Waste Problem", and would prefer to see this point more specifically addressed.

The final sentence in 2.1 is incomplete.

p.4: para.2 and 3. 2.2 Both "past performance of the nuclear industry in managing nuclear fuel waste", and "trends and characteristics of public concern...." must not be restricted to Canadian examples.

p.4: para.5. 2.3 "...all means through which nuclear fuel waste may directly or indirectly impact...." should specifically include all aspects of the production of nuclear waste, including the mining and processing of uranium, and the operation of nuclear reactors, especially with regard to the relationship between radiation and health.

"pathways and linkages within our social systems which enable people to understand and internalize risk perceptions" should be more explicit. (eg) does this refer to education?

p.9: 3.512 Similarities as well as differences should be justified.

Any container tests should be described.  
The effects of chemical and biological interactions with containers should also be described.



p.24: 3.82 Similarities as well as differences should be described.

Any transportation container tests should be described.

p.27: 3.9 Cost analysis should include a description of liability.

At no point is there an opportunity to examine the impacts of international developments in nuclear fuel waste management; similarly there is no opportunity to review the impact of approval of AECL's concept on international developments in nuclear fuel waste management.

On some issues, the Guidelines come close to including NAC's concerns about the scope of this review.

In particular, they appear to address the question of future quantities of waste (in 2.1); they call for consideration of past performance of the industry, as well as social perceptions of nuclear waste management (in 2.2). They call for an examination of the evolution of radiation exposure limits (2.3).

At (2.4), there is a requirement for a discussion of provisions to ensure the long-term management of nuclear fuel waste in Canada and internationally, which presumably must include questions of nuclear safeguards and ~~and~~ the potential for nuclear weapons proliferation.

The Guidelines call for justification of assumptions and rationale of significant decisions, and of the use of a "generic" research approach. They also call for an examination of uncertainties (in 3.0). They allow for a discussion of public consultation programs. Criteria for abandonment or rejection of a vault or rock mass are requested, (3.513, 3.52). Rationales and justification for parameters and assumptions in modelling are to be examined. (3.514, 3.522, 3.532, 3.54, 3.541, 3.542). They call for discussion of conceptual simplification, and computing equipment capability. (3.545, 3.546).

On the socio-economic side, the Guidelines require description of infrastructure adjustments, conflict resolution mechanisms, community involvement, and emergency planning. (3.71, 3.72, 3.73, 3.74).

The "Study Strategy" proposal for the examination of environmental impacts covers many essential questions. However, to reiterate the point made above, a "study strategy" cannot be considered to be an environmental impact assessment.

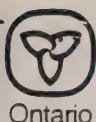
*Prepared by Anne Lindsey  
for NAC*











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September 13, 1991

MEMORANDUM

**TO:** Susan Toller  
Federal Environmental Assessment Review Office  
13th Floor, Fontaine Building  
200 Sacre-Coeur Blvd.  
Hull, Quebec. K1A 0H3

**FROM:** Wilfred Ng  
Manager, Special Wastes & Manifest Section  
Waste Management Branch

**RE:** Draft Environmental Impact Statement Guidelines -  
Nuclear Fuel Waste Management

Please find attached comments on the above document from our Ministry's Environmental Assessment Branch (EAB). No decision has been made on the lead Ministry to represent the Ontario Government on this issue, and since written comments are due by September 16, 1991, we are providing these staff level comments on that basis.

W. Ng  
Attachment

c.c. G. Ronan  
D. Bartkiw  
R. Clarke/P. Becker

WP/AC.1184M



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of the  
Environment

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de  
l'Environnement

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440-3457

September 11, 1991

**MEMORANDUM**

TO: Arie Cohen  
Project Engineering Specialist  
Waste Management Branch

FROM: Pat Becker  
Environmental Planner  
Environmental Assessment Branch

RE: Environmental Assessment of the AECL Nuclear Fuel  
Disposal Concept

Further to the request from Bill Bardswick of July 16, 1991 the Environmental Assessment Branch has reviewed the "Guidelines for the Preparation of an Environmental Impact Statement" for the Nuclear Fuel Waste Management and Disposal Concept from Atomic Energy of Canada Limited (AECL).

From the EA Branch's perspective the document appears to address the issues adequately. The only comment that the EA Branch has is that the site selection is limited in comparison to the provincial requirements.

The site selection could involve greater input from the public and affected parties, since this aspect is often a contentious issue in the EA process. The proposed Assessment Design Document (ADD) could be used as basis for the framework for the site selection. The ADD is prepared at the start of the planning and consultation phases and is reviewed with the public. This could encourage public involvement and participation in the site selection process and potentially reduce the concerns and issues raised.

It is difficult to ensure that all issues will be addressed since this guideline provides only an outline of the environmental impact statement. Therefore, the EA Branch would request that subsequent documentation be forwarded to us for comment, thereby maintaining our involvement in the process.

Pat Becker

cc: W. Bardswick, WMB  
R. Clarke, EAB







COMMENTS ON THE DRAFT GUIDELINES  
FOR THE PREPARATION OF  
AN ENVIRONMENTAL IMPACT STATEMENT:

NUCLEAR FUEL WASTE MANAGEMENT AND DISPOSAL CONCEPT

PREPARED BY THE  
SCIENTIFIC REVIEW GROUP

September 1991





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### Preamble

This document was prepared by the Environmental Assessment Panel reviewing the Nuclear Fuel Waste Management and Disposal Concept. It contains the draft Guidelines for the preparation of an Environmental Impact Statement (EIS). The draft EIS Guidelines identify the issues which the Panel has determined should be addressed in the EIS. The EIS will be prepared by the proponent, Atomic Energy of Canada Limited (AECL).

The federal Environmental Assessment and Review Process requires that proposed projects that may result in significant adverse environmental effects be referred for public review to an Environmental Assessment Panel appointed by the Minister of the Environment. In September, 1988, AECL submitted for public review its concept for the deep geological burial of nuclear fuel waste in the Canadian Shield. A Panel was appointed in October, 1989, and was given the mandate to examine the safety and acceptability of the AECL Concept, along with a broad range of nuclear fuel waste management issues.

The Panel held public scoping meetings in fourteen cities during October and November, 1990 to obtain comments on the identification of issues which should be addressed by the proponent in its EIS. These comments, as well as those received from written submissions, were considered by the Panel when developing its draft EIS Guidelines.

The draft EIS Guidelines will be available to the public for comment until September 16, 1991. The Panel will then finalize this document and issue it to AECL. Additional information may be requested by the Panel from other sources, including government agencies, in areas of their expertise or regulatory responsibility.

The Panel will receive the EIS submitted by the proponent and will distribute it to review participants for comment. If the Panel decides that the EIS is inadequate, it will ask for additional information before scheduling public hearings. Once the Panel is satisfied that the EIS has adequately addressed the issues identified in the Guidelines, it will announce public hearings. Review participants will have the opportunity to present their views on the environmental and socio-economic aspects of the AECL proposal at the public hearings.

The Panel will consider all of the submissions received during public hearings and will present its conclusions and recommendations in its report to the Ministers of Environment and of Energy, Mines and Resources. The Minister of Energy, Mines and Resources, after discussion with the Minister of Environment, will decide whether the project should proceed, and if so, under what conditions.

## 1. Introduction

The Nuclear Fuel Waste Management and Disposal Concept proposed by AECL will be referred to as "the concept". Interim storage and transportation of nuclear fuel waste are considered to be part of the concept. The areas of responsibility of the proponent should be clearly identified.

The EIS should describe all components of the proposed AECL concept and the potential impacts on humans and the natural environment due to concept implementation. The need for the concept should be fully explained, and alternative nuclear fuel waste management options should be examined in comparison. Potential impacts of the concept on humans and the natural environment should be discussed by summarizing the present conditions of human communities and the natural environment, and predicting the possible impacts that could result from the concept. Measures which could reduce or eliminate adverse impacts should be explained.

The Panel would appreciate the proponent presenting its EIS in the format outlined in the Guidelines. AECL should address the items identified in each section of the Guidelines, but should not be limited to these items as some subjects may require a broader discussion. Both positive and negative effects of the concept should be included.

Due to the complexity of the technical aspects to be addressed, the use of diagrams and charts wherever possible is recommended. A glossary of technical terms would be helpful, as well as the proponent's definitions of words which may otherwise be interpreted in various ways (e.g. environment, disposal, safety, modelling, risk, acceptability, background radiation, etc.). A bibliography of the references used to prepare the EIS should be included.

"Short-term" and "long-term" will be used throughout this document to identify ranges of time. Short-term refers to the time period of planned human activities at the proposed repository. Long-term refers to the time period after the closure of the facility.

The EIS should begin with a summary of the document and its findings. The summary should be easily understood by a layperson. It should provide the reader with a concise idea of the contents of the EIS and should focus on items of specific interest.

The EIS Summary and main document should be available in both English and French. Technical documents should be provided in the appropriate working language.

The EIS summary should be included as part of the EIS. It should be prepared for wide distribution as a document separable from the



EIS itself.

## **2. Nuclear Fuel Waste - The Problem**

The EIS should define and explain the overall problem of nuclear fuel waste management in Canada, and discuss the present magnitude and expected growth of this problem. It should document the need for long term management of nuclear fuel waste and why this issue must be addressed now. The EIS should specify the risks to the health of humans and the natural environment, and describe the origin and nature of nuclear fuel waste to provide a clear understanding of the requirements for its safe management. Current methods of nuclear fuel waste management in Canada should be discussed.

### **2.1 Risks to the Health of Humans and the Natural Environment**

The EIS should discuss and provide general background information about the risks to the health of humans and the natural environment that are associated with nuclear fuel waste. This discussion should include, but not be limited to, the following:

- definition of "health";
- definition of "risk";
- perceived versus actual risks and actual health risks, public understanding of these risks, and pathways and linkages within our present social systems which enable people to understand risk perceptions;
- processes and mechanisms through which radionuclides and other contaminants may directly and indirectly impact on humans and various organisms in the natural environment;
- explanation of effects of radiation on humans and the natural environment, including probability of exposure and the quantification of risk;
- the relationship between radiation and health, and the evolution of health regulations pertaining to radiation, including national and international radiation exposure limits;
- methodologies used in risk assessment and in health assessment, their validity including a discussion of underlying assumptions, and the theoretical justification for the rationale behind these methodologies;

- theoretical justification for the manner in which probability and magnitude of risk are calculated.

## **2.2 Nature of Nuclear Fuel Waste**

The EIS should clearly explain the nature and magnitude of the present nuclear fuel waste management problem, by describing the origin of nuclear fuel waste and other materials intended for disposal and those characteristics that are critical in the evaluation of the disposal concept. This should include, but not be limited to, the following:

- the types, sources, quantities and locations of nuclear fuel waste in storage at the present time and in the future, under various circumstances including i) the present rate of generation, ii) a moratorium on nuclear power plant construction, iii) the implementation of reprocessing, iv) the expansion of electrical generation by nuclear power, and v) the modification of nuclear technology, and the nature of and reasons for uncertainties in future projections;
- the physical and chemical characteristics of nuclear fuel waste, including, for several intervals in the future, lists of prominent radionuclides with statements of the probable chemical form of each radionuclide under expected ambient conditions;
- the nature of the physical and chemical changes that occur in the nuclear fuel while in the reactor, after removal from the reactor, and while in storage or transportation;
- the short-term and long-term variations in the characteristics of the components of nuclear fuel waste including heat, radiation intensity, radiation products and toxicity;
- the possible changes in the nature and characteristics of nuclear fuel waste due to changes in nuclear power technology or in energy policies.

## **2.3 Current Nuclear Fuel Waste Management in Canada**

The EIS should describe current nuclear fuel waste management practices in Canada, and discuss the environmental and ethical acceptability of these practices. Also, the objectives of these practices, as well as their ability to meet these objectives, should be outlined.

Past performance of the nuclear industry in managing nuclear fuel



waste should be documented. Any containment failures that have occurred during storage at, and transport between, nuclear facilities, and any subsequent impacts on humans and the natural environment, should be described. The history of the experience with containment designs and construction materials should be outlined.

The trends and nature of public concern related to nuclear fuel waste management since the beginning of the production of this waste should be described. Changing social perceptions on this issue should be addressed, including information on preferences or stated positions for irretrievable versus retrievable management, and the attitudes of people living near current storage facilities.

The EIS should compare and contrast Canada's current nuclear waste management practices to practices in other countries.

#### **2.4 Risks due to Current Nuclear Fuel Waste Management**

The EIS should discuss the risks to the health of humans and the natural environment that are associated with the current management of nuclear fuel waste. This discussion should incorporate issues discussed in Section 2.1 where appropriate and should include, but not be limited to, the following:

- risk criteria which relate to human health and environmental protection, and assumptions taken in development of these criteria;
- distinction between risks due to the current management of nuclear fuel waste and risks due to background radiation;
- risks resulting from social processes (e.g. human intrusion), geological processes (e.g. earthquakes, meteorite impacts, rupture of bedrock due to post-glacial isostatic rebound), microbiological processes, and changes in the surface environment (e.g. near-term climate change);
- risks from possible accidents that may result in radiation exposure or the release of other contaminants (e.g. an unexpected major leakage).

#### **2.5 Security of Long-Term Management of Nuclear Fuel Waste**

The EIS should elaborate on the provisions that currently exist to ensure the security of long-term management of nuclear fuel waste in Canada and internationally, including provisions to safeguard knowledge or nuclear expertise against loss. Examination of the

history of the performance of these provisions, and their ability to accommodate the requirements of future long-term management options should be included.

### **3. The AECL Concept**

The EIS should describe thoroughly the concept and its suitability for the long-term management of nuclear fuel waste. Due to the complexity and recent development of the technology involved, the lack of experience in its implementation, and the conceptual nature of information concerning a potential site, it is important that the discussion of the concept is presented clearly. The following issues should be addressed throughout this document, wherever they may be appropriate:

- the assumptions and rationale underlying all major decisions (e.g. decisions taken that will assist reviewers in their understanding and evaluation of the concept);
- regulatory criteria (particularly for health and risk), their adequacy and feasibility of being met, and areas where further development of criteria is required and where no criteria presently exist;
- the treatment of uncertainties, in particular, irreducible uncertainties, and areas of knowledge where differing opinions remain unreconciled within the scientific community;
- the use and justification of site-specific data, and its representativeness of human communities and the natural environment in candidate site environments;
- the flexibility of the concept or key components of the concept to accommodate possible unanticipated changes, e.g. changes in technology, in the selection of or preference for host rock, in the understanding of environmental hazards and risks, in regulatory criteria, in social priorities and values, and in government policies.

#### **3.1 Description of the Concept**

The EIS should provide a general overview description of the proposed concept, including interim storage, handling, transportation, and surface and sub-surface facilities. The EIS should describe the management of a nuclear fuel bundle from its removal from inside a reactor to its emplacement in the proposed underground vault.

### 3.2 Development of the Concept

The EIS should summarize the history of, the rationale for, and the criteria and assumptions related to the formulation and development of the concept, and any decisions taken that will assist in the understanding of this formulation and development. The EIS should also discuss the likelihood of changes in any of these decisions, the implication of these changes for concept design and implementation, and the extent to which these changes could be accommodated.

#### 3.21 History of Concept

In describing the history of the development of the concept, the EIS should examine, but not be limited by, the following:

- the sequence of events that has resulted in the proposed nuclear fuel waste management program in Canada;
- the roles of key parties involved in decision-making;
- public consultation in the development of the nuclear fuel waste management program;
- the current status of the program, and a summary and schedule of research planned, in progress, or completed, including the identification of the status of any planned or ongoing research which may not be completed before public hearings.

#### 3.22 Rationale for Irretrievable Burial

The EIS should outline the reasons for developing a concept based on irretrievable burial instead of retrievable storage. The implications of the proposed concept on future generations, and the present society's responsibilities to those generations should be discussed. The advantages and disadvantages of irretrievable burial versus retrievable storage, and implications regarding overall risk, should be explained.

#### 3.23 Criteria and Assumptions

The EIS should outline the regulatory criteria with which it must comply, as well as the criteria the proponent it has established and the assumptions it has used during the development of its



concept. This should include, but not be limited to, the following:

- definitions of safety and acceptability;
- criteria and assumptions for safety, and technical and social acceptability;
- criteria used for a decision to close and decommission an underground vault;
- criteria and assumptions for responsibility to future generations;
- the ability of the concept to meet the requirements of regulatory criteria, as well as the proponent's own criteria for safety, and technical and social acceptability.

### 3.3 Potential Risks due to the Proposed Concept

The EIS should discuss the risks to the health of humans and the natural environment that are associated with the proposed concept for the management of nuclear fuel waste, and how these risks will differ from those associated with the current management of nuclear fuel waste. This discussion should incorporate issues discussed in Section 2.1 where appropriate and include, but not be limited to, the following:

- risk criteria which relate to human health and environmental protection, the assumptions taken in development of these criteria, and how these criteria differ from those associated with the current management of nuclear fuel waste;
- distinction between risks due to the proposed concept for the management of nuclear fuel waste and risks due to background radiation;
- risks resulting from social processes (e.g. human intrusion), geological processes (e.g. earthquakes, meteorite impacts, rupture of bedrock due to post-glacial isostatic rebound), microbiological processes, and changes in the surface environment (e.g. climate change);
- risks from possible accidents that may result in radiation exposure or the release of other contaminants (e.g. an unexpected major leakage).

### 3.4 Capability to Address the Need for Secure Long-Term Management

The EIS should discuss the capability of the proposed concept to address the risks to the health of humans and the natural environment and to meet the need for the long-term management of nuclear fuel waste. The discussion should include a comparison of the range and distribution of risks, in the short-term and long-term, incurred by current nuclear fuel waste management practices compared to those which would be incurred by the proposed concept.

### 4. Alternatives to the Proposed Concept

The EIS should discuss the capability of possible alternatives to the proposed concept to address the risks to the health of humans and of the natural environment and to meet the need for long-term management of nuclear fuel waste. The EIS should also indicate how the proposed concept compares in terms of possible social impact, risk and cost with other possible alternatives. Each alternative should be described at a sufficient level of detail to permit a meaningful comparison with the proposed concept. This discussion should include, but not be limited to, the following;

- a review of current practices adopted by other countries for the management of nuclear fuel waste and other high-level radioactive waste;
- a consideration of the implication of a number of separate or dispersed repository sites instead of one consolidated facility;
- a consideration of alternative media for disposal of nuclear fuel waste in Canada;
- above-ground storage;
- a consideration of controllable, retrievable, monitored storage at a centralized underground waste management facility;
- a consideration of the transmutation of nuclear fuel waste.

The EIS should describe any significant differences between nuclear fuel waste produced in Canada and in other countries (e.g. waste produced from enriched versus natural fuels, reprocessed versus non-reprocessed waste), and explain how these differences might influence the selection of a disposal concept.



In the discussion of alternatives, philosophical questions should also be considered, including the following:

- should future generations be burdened with the need to monitor a repository?;
- should the option of reversing the decision to bury nuclear fuel waste permanently be made more difficult for future generations?

## **5.0 Isolation of Nuclear Fuel Waste - The Multiple Barrier System**

The EIS should explain the objectives, principles and assumptions involved in the development of the proposed Multiple Barrier System to isolate nuclear fuel waste. In this explanation, the term 'barrier' and the relationships between barriers should be defined, and examples of barriers from the entire system should be given. The EIS should also describe each component of the Multiple Barrier System in physical, chemical and biological terms, its specific functions and, in particular, the linkages among the various components. The EIS should also discuss how possible malfunctions of one or more of the barriers, or potential changes in the vault environment, could affect the overall performance of the Multiple Barrier System.

The EIS should discuss procedures for the evaluation of the performance of the components and of the total system for the anticipated time required for nuclear fuel waste isolation. This discussion should identify the critical stages and expected times leading to the ultimate failure of each component and of the whole system, and it should locate these stages on time charts. Uncertainties in these expected times should be discussed, and critical stages leading to the ultimate failure of each component and of the entire system should be identified.

The EIS should also demonstrate that adequate long-term performance criteria have been developed for each of the components of the system, and for the system as a whole. A comparison with regulatory criteria adopted for nuclear fuel waste management programs in other countries with significant nuclear fuel waste should also be provided.

Since the ultimate objective is to delay or prevent the dispersal of radionuclides and other contaminants into the environment, the EIS should discuss the migration of radionuclides and other contaminants at all stages and through all barriers. In this discussion, the EIS should consider, but not be limited to, the effects of pH, Eh, temperature, rock composition, groundwater flow rate, microbiota and other factors on the migration of radionuclides and other contaminants through various barriers.



## 5.1 The Engineered Barriers System

The EIS should describe the components of the proposed Engineered Barriers System and the methods employed for the evaluation of these components. It should describe the characteristics of the vault environment, and the processes that govern the migration of radionuclides and other contaminants within that environment. It should also describe and evaluate the changes that may occur in these characteristics and processes over both the short-term and the long-term. The EIS should address the possibility of components of the nuclear fuel waste attaining critical mass.

### 5.11 Nuclear Fuel Waste

The EIS should describe the role of the nuclear fuel waste itself, as part of the Multiple Barrier System. The effectiveness of the nuclear fuel waste as a barrier should be evaluated, taking into account its chemical and physical stability, potential for biological mobilization, and its susceptibility to damage from its own radiation and heat. The basis for the decision concerning the form in which the waste is to be placed in the container should be explained. This decision should be compared and contrasted with alternatives adopted by waste management systems in other countries, and significant differences should be explained and justified.

The EIS should discuss the hazardous components and characteristics of the nuclear fuel waste, in particular the important radionuclides and the heat production as a function of time. This discussion should include, but not be limited to, the following:

- identification and ranking of the radionuclides and other hazardous components that may be associated with potential health risks to humans and to the natural environment;
- description of the relevant chemical and physical properties of these radionuclides and other hazardous components, including their dynamic change in the short-term and the long-term.

The effect of heat and radiation on the physical and chemical integrity of nuclear fuel waste should be discussed, particularly with respect to the rates of ultimate release of specific radionuclides. The EIS should describe the methods used to estimate radionuclide release and consider the following:

- rates and processes of the dissolution of nuclear fuel waste;

- the development of regions of induced strain and of voids;
- the effect of radiation-induced changes on leaching rates of structural components and of critical nuclides;
- the potential for the generation of gases by chemical, nuclear and biological processes, and the consequences of the presence of these gases;
- the potential for other biological and microbiological interactions with nuclear fuel waste;
- the possible dissolution mechanisms of nuclear fuel waste including biologically mediated mechanisms and selective leaching.

The EIS should provide details and specifications of the pre-disposal storage of nuclear fuel waste, including location, storage time and the effect of storage and handling on the integrity of nuclear fuel waste, and its effectiveness to perform as a barrier.

#### 5.12 The Container System

The EIS should describe the role of the container system in the Engineered Barriers System. The components of the proposed container system that would function as a barrier against the migration of radionuclides and other contaminants should be discussed. The preferred container system should be compared to and contrasted with alternative container system concepts developed by waste management programs in other countries, and significant differences should be explained and justified.

The EIS should describe and justify the design and manufacturing criteria applied to the container system. This discussion should include, but not be limited to, the following:

- the selection of container design including provisions for change and future improvements;
- the selection of structural materials for the container system including present and future availability of materials, and provisions for change;
- the suitability of the designed container system for the selected method of handling and emplacement; and
- the inspection and quality control procedures for all stages from fabrication to emplacement under full-scale operational conditions.



The EIS should discuss the circumstances and mechanisms leading to all possible causes of container failure, in particular container breaching either by corrosion mechanisms operating in the vault environment or by the crushing action of all possible rock pressures. Measures to delay or reduce the possibility of breaching, and to minimize its effects should also be described.

The EIS should describe the predicted performance of the container system by identifying all probable modes of (total and local) failure of the container, taking into account the thermomechanical history from fabrication through emplacement. The description should include, but not be limited to, the following:

- a definition of "container failure", and a discussion of the consequences of single or multiple container failure;
- a description of possible models for container failure, a discussion of the extent to which such models have successfully predicted failure in past experiments, and how relevant these experiments were to anticipated vault conditions;
- a discussion of the mechanisms of weakening of the material of the container system including, but not limited to, the effects of chemically reducing conditions, groundwater conditions, gases, and microbially-induced corrosion;
- a discussion of the environment in which the container is emplaced with respect to its possible influence on corrosion and other modes of failure;
- the validity of long-term data extrapolation for time-dependent container degradation mechanisms;
- the application of possible natural and other analogues to the container system and its components.

The EIS should describe methods to be used for monitoring the integrity and performance of the container under vault conditions including:

- a description of monitoring methods to assess performance and to anticipate early failure;
- a statement of the criteria for tolerable deviations from predicted behaviour;
- a consideration of the effects of radiation and radiolysis on corrosion and embrittlement of a container.



### 5.13 The Vault System

The EIS should describe the role of the vault in the Multiple Barrier System. It should examine the entire proposed vault system, and all aspects of the vault design, construction, operation, sealing and subsequent monitoring that bear on its functioning as a barrier against the migration of radionuclides and other contaminants. The EIS should describe, and show an understanding of, the anticipated flow of water through all components of the sealed vault, and along the boundaries of these components.

The preferred vault system should be compared to and contrasted with alternative vault system concepts developed by waste management programs in other countries, and significant differences should be explained and justified.

The EIS should describe the criteria and procedures to be used in the design, construction and operation of the vault. This description should include, but not be limited to, the following:

- the intended function of the vault within the Multiple Barrier System;
- the choice of excavation technology and its justification;
- the criteria used in the design of the vault, including the choice of an appropriate depth;
- an evaluation of in-room emplacement of containers versus borehole emplacement, with reference to vault construction, overall stability and operation;
- an evaluation of the risk of instability of the underground openings both locally and globally, including responses to static, thermal and seismic loads;
- an evaluation of fracturing of the rock mass induced by excavation process, and of its impact on the functioning of the rock mass barrier;
- a discussion of criteria for abandonment or rejection of a vault or sections of a vault in which the rock or fracture characteristics are found to be different from those expected;
- a demonstration of the capability to characterize in-situ stresses and estimate elastic strain energy at the appropriate depths in a rock mass, and their potential short-term and long-term consequences;
- an evaluation of the thermal effects of the vault and the

nuclear fuel waste on geomechanical properties and processes;

- a discussion of earthquake-resistant design, including the possibility of increased earthquake activity due to glaciation and deglaciation.

The EIS should describe the potential for, and consequences of, unplanned events during loading of containers and monitoring stages. This should include, but not be limited to, the following:

- a discussion and evaluation of the methods and hazards of handling the nuclear fuel waste at the various stages;
- a description and evaluation of the container emplacement method and technology, and the quality assurance and control procedures to be used during emplacement;
- an outline of the procedures and standards for the training of staff and the operation of equipment;
- a demonstration of the ability to retrieve, decontaminate, and repair damaged containers during all phases of vault operation;
- a description of procedures for handling contaminated materials and equipment;
- a demonstration of the availability of appropriate instrumentation and monitoring techniques for the assessment of deviations from predicted thermal, geomechanical and hydraulic behaviour;
- a description of the contingency plans to take advantage of situations which are more favourable than predicted, and the capability to manage and correct all situations where unfavourable departure from predicted performance are encountered, including retrievability of nuclear fuel waste, if necessary.

The EIS should describe the vault sealing program including the following:

- the criteria to be used in making the decision to seal the vault, including an assessment of acceptable differences between the forecast and the observed performance of the vault;
- the sources of sealing materials (buffer, backfill and grout), and the methods used to extract or manufacture the sealing materials;
- the transportation, emplacement and compaction methods, and

the equipment used;

- the quality control of the production and application of sealing materials, including methods of evaluation and criteria of selection and rejection, and the data or experience upon which these criteria are based;
- the functions of the various sealing materials (e.g. radiological barriers, restriction of groundwater flow);
- the nature of the contacts between the sealing materials and the rock mass, and the sealing materials and the containers, and, particularly, the potential occurrence and significance of gaps at these contacts due to consolidation, shrinkage, and ineffective emplacement of the sealing materials;
- the expected long-term performance and integrity of the sealed vault, particularly under conditions of elevated temperature, and full or partial groundwater saturation, and the uncertainties involved;
- the effects of biofouling of the vault, and the sealing materials.

## 5.2 Rock Mass Barrier

The EIS should define and justify the role of the rock mass as part of the Multiple Barrier System.

The EIS should explain how a generic model for the rock mass can be established and justified. It should explain how field evidence and tests from actual sites can be used to determine generic parameters and characteristics of the rock mass and the associated groundwater flow system. The discussion of those properties of the rock mass and the groundwater flow system that could affect the migration of radionuclides and other contaminants should include the following:

- procedures for obtaining a representative description of the important generic geological, hydrogeological, geochemical, biological, thermal, and geomechanical properties and their spatial variations (including ranges of values and their uncertainties);
- identification and characterization (including ranges of parameters and uncertainties) of inhomogeneities and discontinuities in the rock mass and groundwater flow system (such as fracture systems) that will affect the transport of radionuclides and other contaminants;



- relevant physical, chemical, biological and biochemical processes in the rock mass and groundwater flow systems that may impede or enhance the transport of radionuclides and other contaminants, and the coupling between these processes;
- factors that determine the transport of radionuclides and other contaminants from the vault into the rock mass, and from the rock mass and the groundwater flow system into the surface environment;
- ranges of rates and volumes of fluid flow and transport of radionuclides and other contaminants through the rock mass to be expected under present and future conditions (including the associated uncertainties);
- short-term or transient changes in the processes and properties of the rock mass and the groundwater system that may be expected due to the establishment of the disposal vault, including the effect of the biological and thermal changes due to the construction and loading of the vault;
- long-term changes that may affect the rock mass or the groundwater system, for example global climate change, post-glacial isostatic rebound, or renewed glaciation;
- potential changes in the relevant properties and processes in the rock mass due to stress changes, possible geologic events such as earthquakes, or meteorite impact effects at the disposal vault depths considered;
- procedures for and limitations of seismic risk assessment (e.g. seismic monitoring, geologic evidence for faulting and earthquakes).

Criteria for the rejection of a rock mass on the basis of its geological, hydrogeological, geochemical, biological, thermal and geomechanical properties, as well as on the basis of assessment of seismic risk, should be stated.

### 5.3 Surface Environment

The EIS should define and justify the concept and generic characteristics of the surface environment used in assessing environmental impacts. The description of the generic surface environment should clearly indicate: (1) which processes, components and pathways are important and why; (2) the ranges of parameters that are used and how they were selected; and, (3) any simplifying assumptions used.

The description of the generic surface environment should include, but not be limited to, the following:

- the key physical, chemical and biological processes that control movement and concentration of radionuclides and other contaminants in the surface environment;
- the key linkages among the physical, chemical and biological processes in the rock mass and in the surface environment;
- the critical pathways and net transport of radionuclides and other contaminants;
- how short-term or transient changes in processes and properties of the surface environment are dealt with (e.g. changes caused by excavation and loading of the vault, near-term regional or global climate change);
- how long-term changes are dealt with (e.g. possible global climate change, such as renewed glaciation, or changes due to tectonic or post-glacial isostatic movements).

#### 5.4 Microbiological Issues

The EIS should address the following microbiological issues with respect to their potential to affect the integrity of the Multiple Barrier System and the release of potentially harmful chemicals to the surface environment:

- the microbiological activities that are probable or possible at all stages, from nuclear fuel waste preparation and storage to transport and emplacement in the vault and rock mass system, including the relative importance of indigenous or introduced organisms;
- the most important sources of nutrients that may be available to microbes at all stages, including those sources in the rock mass at the proposed vault depth, and in the groundwater, and those introduced by vault construction, loading and sealing;
- the potential rate (with ranges and uncertainties) of microbially-induced corrosion of the disposal containers, including the influence of thermal loading, saline groundwater and of radiolysis and gas emanations;
- the probability or possibility of enhanced microbial mutation or evolution resulting from higher than normal background radiation levels, and the potential effect of such changes on radionuclide or chemical transport and release;



- the potential, at all stages, for intrinsic microbial activities to affect the formation of radiocolloids which influence the adsorption or movement of radionuclides and other contaminants;
- the nature and rates of microbially mediated processes which may result with the release of radionuclides and other contaminants from a disintegrating vault, the mechanisms by which these contaminants may be modified (e.g. through methylation), the forms in which the modified contaminants may reach the surface environment, and the various possible impacts on humans and the natural environment which may result.

#### **6.0 Performance Assessment of the Generic Multiple Barrier System**

The EIS should discuss in detail the procedures used to predict the long-term performance of the generic Multiple Barrier System in terms of risks to the health of humans and the natural environment. In this discussion, consideration should be given to specific issues raised in Sections 2.1 and 3.3. Description of the various approaches taken (i.e. mathematical modelling and simulation, analogues, etc.), and of how these approaches are used and integrated should be included in the discussion. A clear statement of the objectives and limitations of the modelling should be given. The extent to which these procedures are flexible enough to accommodate future development and refinements should be examined. The performance assessment should be compared and contrasted with alternative assessments developed by nuclear waste management programs in other countries and significant differences should be explained and justified.

A schematic representation of the relationships and linkages of models within the entire performance assessment complex should also be included in the EIS.

#### **6.1 Selection and Development of Models for Multiple Barrier System Modelling**

The EIS should discuss in detail and justify the selection and development of the mathematical models and other methods used in the performance assessment of the generic Multiple Barrier System. The discussion of model structure should be organized, as far as possible, according to components that are to be represented in the model structure, processes and mechanisms, and spatial and temporal scales. Assumptions and limitations of the models should be



clearly identified.

### 6.11 Assumptions and Model Limitations

The assumptions made in the model development and the resulting limitations inherent in the models should be discussed. The discussion should include, but not be limited to, the following:

- the assumptions made concerning any of the processes and mechanisms, the justification for making these assumptions, and the model limitations resulting from the assumptions made;
- any uncertainties in the model output resulting from assumptions made in the model development;
- the adequacy of the processes and mechanisms selected for representing the long time scale;
- the ability of the models to incorporate additional processes, mechanisms, and boundary conditions;
- the choice of dimensionality for each type of model, and the justification for the choice;
- the representation of fracture systems in the rock mass, the associated groundwater flow systems, and the channelling of groundwater flow within the fracture systems;
- the interfacing between the various components, and the coupling among the various processes and mechanisms and the justification for assuming uncoupling in certain cases;
- the capability of the various models to accommodate changes in time and space of the external conditions, the system geometry, or other changes;
- the implications with respect to the performance assessment of the Multiple Barrier System arising out of the structural limitations of the models.

The EIS should discuss the implications of conceptual and numerical simplifications made for computational convenience.

The EIS should also evaluate the adequacy of the presently available computing equipment to accomplish general simulations while utilizing the full capabilities of the available models (e.g. a three dimensional simulation involving the coupled processes of groundwater flow, heat transport, geomechanical response, and radionuclide transport using a reasonably detailed finite element grid). The EIS should discuss what additional computing equipment,

if any, is required for a reasonable utilization of available models.

## 6.2 Determination of Model Parameters

The EIS should discuss the parameters and data used in the mathematical models, as well as the methods used for determining these parameters. The discussion should include, but not be limited to, the following:

- parameter and data requirements;
- parameter identifiability, stability, and uniqueness;
- criteria used for the selection of parameter ranges, and the justification for the selection;
- the adequacy of the chosen ranges of the parameters over time, particularly the long time scale;
- the method chosen for translating results of hydrologic tests into model input parameters;
- the method chosen to relate stress changes in the rock mass to changes in the hydraulic parameters;
- the method chosen to translate fracture or channel hydraulic parameters into bulk hydraulic parameters;
- the method chosen to translate results from the groundwater flow model into groundwater velocities for transport modelling;
- the time-dependence of all parameters in the short-term (e.g. due to seasonal variations), and the long-term (e.g. due to global warming or glaciation);
- uncertainties in the ranges of the parameters used, as well as uncertainties in the variations of these parameters over time;
- the approach chosen to represent and quantify parameter and data uncertainty and parameter errors over the required time scale;
- the use and validity of parametric probability functions, auto-correlation, and cross-correlation, particularly over the long time scale;
- the desirability to reduce parameter and data uncertainty by collecting additional data, and the cost-benefit relationship

- the groundwater flow system;
- the thermal regime;
- the geochemical regime;
- the biological and microbiological regime in the subsurface;
- physical, biological, and ecological systems in the surface environment;
- the interaction between the various regimes, systems, and processes and mechanisms.

#### 6.51 The Short-term

The modelling procedure to evaluate the short-term response of the physical system(s), and the scenarios modelled, should be described. For this purpose, the short-term may be subdivided into suitable sub-intervals, for example:

- the construction stage;
- the loading stage;
- the immediate (monitored) post-closure stage.

The discussion of the short-term modelling should include, but not be limited to, the following:

- a statement of the objectives;
- a list of the processes and mechanisms that are considered to be relevant for the short-term, and a justification for the choice;
- the degree of coupling assumed between the selected processes;
- the spatial scale that is considered to be relevant for the short-term;
- an assessment of what is realistically achievable and what is not achievable by modelling over the short-term.



### 6.52 The Long-term

The modelling procedure used to evaluate the long-term response of the physical system(s), and the scenarios modelled, should be described. For the long-term, responses should be modelled, at least, for the following external conditions:

- unchanged external conditions;
- the occurrence of possible long-term changes in the geosphere and biosphere (e.g. global warming, post-glacial isostatic rebound, renewed glaciation) and associated changes in ecosystems;
- the occurrence of catastrophic or unusual events (e.g. earthquakes, meteorite impact).

The discussion of the long-term modelling should include, but not be limited to, the following:

- a statement of the objectives;
- a list of the processes and mechanisms that are considered to be relevant for the long-term, and a justification for the choice;
- the degree of coupling assumed between the selected processes;
- the spatial scale that is considered to be relevant for the long-term;
- an assessment of what is realistically achievable and what is not achievable by modelling over the long-term.

Since the "long-term" transcends the time scale of recorded human experience, the modelling undertaken here differs fundamentally from any other mathematical modelling activity performed so far. Particular care should therefore be taken in the discussion of long-term performance modelling. The discussion should include, but not be limited to, the following points:

- the validity and reliability of "long-term" performance modelling, and how this validity and reliability was determined;
- limitations of long-term predictive modelling due to model structure (i.e. the selection of processes and mechanisms);
- limitations of long-term predictive modelling due to parameter and data uncertainty;

- methods for quantifying predictive uncertainty and errors, and for relating predictive uncertainty to parameter and data uncertainty;
- the adequacy and validity of the adopted methods for dealing with parameter uncertainty over the long-term;
- the degree of confidence in the long-term predictions, and the method chosen to express this degree of confidence;
- any special measures taken to enhance the reliability of long-term predictive modelling;
- the interpretation and meaning of the results produced by the models for the long-term.

## **7. Concept Implementation**

In addition to developing an acceptable concept for the long-term management of nuclear fuel waste, the EIS should discuss the strategy and methodology for the implementation of the concept. This discussion should include i) a demonstration of the capability for investigating and characterizing actual candidate sites, ii) a description of the major activities which would occur during the construction, operation and decommissioning of the concept facility, iii) a description of the proposed plan for the transport of nuclear fuel waste from storage facilities to underground emplacement, and iv) an estimate of the total cost of the concept, as well as estimates for its major components.

### **7.1 Site Characterization**

The EIS should demonstrate a capability for investigating and characterizing actual candidate sites. Characterization procedures should include unambiguous criteria for determining when an actual site satisfies, or how it could be modified to satisfy, the generic requirements for acceptability. Criteria for rejection of a site should also be included. In the case of multiple candidate sites, the characterization should indicate procedures and criteria for ranking sites, including the involvement of the public in these procedures.

### 7.11 Characterization of the Natural Environment

The EIS should discuss the investigation and characterization of natural environmental aspects of candidate sites. This discussion should include, but not be limited to, the following:

- the properties of and the various processes occurring in the host rock mass and surface environments of the candidate sites that are to be used in site characterization, and the reasons why these properties and processes were selected;
- a demonstration that appropriate techniques have been developed, proven, and are available for characterization of these properties and processes;
- a demonstration that appropriate techniques have been developed, proven, and are available for the mapping these properties in three-dimensional space;
- a description of methods to be used to generate data for any potential future site, including specified sampling density, measurement frequency, mapping techniques, and criteria for establishing and testing for the precision of site-specific data;
- the implication and significance of data not acquired due to choice of measurement interval, sampling density, measurement techniques, and interpretation;
- a description of methods used to identify and characterize fracture systems and major fracture zones;
- the extent to which geophysical depth sounding and airborne remote sensing should be used for site characterization, and the integration of remote and on-site observation in site characterization;
- an understanding of the uncertainties involved in the characterization of the changes in space and time of the processes and properties of candidate sites, and the capability to quantify these uncertainties;
- a procedure for relating the natural environmental aspects of the site characterization to socio-economic aspects;
- the criteria, and the hierarchy in which the criteria are applied, for acceptance or rejection of candidate sites on the basis of physical, chemical and biological site characteristics, and uncertainties in the site characteristics.



### 7.12 Characterization of Socio-economic Conditions

The discussion of the investigation and characterization of socio-economic conditions of candidate sites should include, but not be limited by, the following:

- a demonstration that appropriate techniques have been developed, proven and are available for sufficient description of all relevant characteristics and interactions occurring in the human environment of the candidate sites;
- a procedure for relating socio-economic aspects of the site characterization to natural environment aspects;
- the criteria, and the hierarchy in which the criteria are applied, for acceptance or rejection of candidate sites on the basis of socio-economic characteristics of the site, and the ability to describe those characteristics.

### 7.13 Modelling of the Natural Environment

The EIS should discuss the methods to be used to integrate data from specific sites and the models used in performance and risk assessment. In this discussion, consideration should be given to specific issues raised in Section 6.0 where appropriate. This discussion should include, but not be limited to, the following:

- the method to translate site specific data into quantities required as input for computational models;
- the methods to assess the effects of any loss of information during data translation due to data averaging or smoothing;
- the effect of uncertainty in model predictions;
- the methods to assess how any loss of information coupled with known or unknown modelling errors affects uncertainty in model predictions;
- the methods to validate models against site-specific data on relevant space and time scales;
- the effect of deliberate assumptions used in models;
- the methods to assess the impact of all factors of uncertainty on the reliability of assessed risk;
- the quality assurance procedures to guarantee that results of

analysis can be verified or reproduced by independent parties.

## **7.2 Site Selection Process**

The EIS should suggest a plan and process for selection of a facility site and transportation routes, should its concept be determined to be safe and acceptable. This should include the following:

- identification of the agency that would administer the site selection and siting process;
- the use of past and current site selection methods, processes, and experiences in the development of the suggested process;
- identification of community decision-making structures, and processes for the incorporation of these decision-making structures into site selection decisions;
- the criteria used to site the proposed repository and transport routes, the application of these criteria, and site elimination criteria;
- the integration of socio-economic and biophysical criteria in the site selection process;
- the integration of the site investigation and characterization into a site selection process; and
- the use of compensation.

## **7.3 Facility Construction, Operation and Decommissioning**

The EIS should describe the major activities which would occur during the construction, operation and decommissioning of the concept facility, and the management-related aspects of these activities. This description should include the following: project management, project activities, labour requirements, and emergency planning.

### **7.31 Project Management**

The EIS should describe the proposal or options for overall project management of the concept. This should include, but not be limited to, the following:

- the project management structure, identifying responsibility and accountability of major sub-systems of the overall operation such as: interim storage, transportation, site construction, waste transfer and emplacement, vault closure, site restoration, and security;
- private and/or public corporation operation in any of the above sub-systems, and the impact on regulatory requirements to control and enforce safety, health and environmental regulation and standards;
- description of conflict resolution and proposed dispute settlement procedures to resolve differences between agencies, communities and contractors;
- scheduling of project phases, construction activities, and construction or improvement of major community infrastructure elements, as well as overall target completion dates;
- short-term and long-term community involvement;
- methodology for ensuring after vault closure of adequate notification to future generations of location, contents and monitoring records of repository.

### 7.32 Project Activities

The EIS should describe the activities associated with the implementation of the various phases of the concept. This should include the following:

- description of activities related to each phase of concept;
- need for local infrastructure to support concept;
- transportation of construction materials, equipment, etc. to and from the site;
- interim storage of nuclear fuel waste at facility;
- handling of waste at facility;
- remedial measures, if required.



### 7.33 Labour Requirements

The EIS should contain information concerning the anticipated labour required for the various phases of the concept, and related health, accommodation and transportation plans. This should include the following:

- employment and personnel policies related to the utilization of local, regional and/or migrant labour force;
- labour force size and skills required during various project phases;
- training programs (especially for local/regional labour force);
- schedule of migrant worker influx(es) during the various project phases;
- worker safety and health programs and facilities to respond to accidents or emergency medical needs;
- need for local or remote, permanent or temporary, living accommodation for migrant labour force;
- transportation of migrant workers to and from the work site;

### 7.34 Emergency Planning

The EIS should outline its emergency planning and response system. This discussion should include the following:

- an emergency response plan, including responsibilities of parties involved, availability of equipment, and public warning systems;
- levels of emergency response that would be planned in all stages planned for the disposal facility;
- accident scenarios;
- the certainty or uncertainty of the longevity of nuclear expertise to respond to emergencies, in the case of the decline of the nuclear industry;
- financial responsibility for emergency response;
- training of emergency response team.

#### **7.4 Transportation of Nuclear Fuel Waste**

The EIS should describe the proposed plan for the transport of nuclear fuel waste from storage facilities to underground emplacement. The transport plan should explain the various components of the transportation system and their operation throughout all stages of the concept implementation. The risks associated with the various components, stages and transport modes should be addressed. The following should be discussed: transportation management, the transport container system, the operation of the transportation system, labour requirements, and emergency planning.

##### **7.41 Transportation Management**

The EIS should discuss the management of the transportation of nuclear fuel waste from storage to its emplacement in an underground vault. This should include the following:

- identification of management structure
- private and/or public corporation operation of transportation system, and the impact of regulatory requirements to control and enforce safety, health and environmental regulation and standards;
- management of transport across political borders;
- processes for community and government involvement in transport decisions.

##### **7.42 Transport Container System**

The EIS should describe the transport container system. The preferred container should be compared to alternative container systems developed in Canada or elsewhere, and significant differences should be explained and justified.

The EIS should describe and justify the design and manufacturing criteria applied to the container system. The discussion should include the following:

- the selection of container design including provisions for change and future improvements;
- the selection of structural materials for the container system

including present and future availability of materials, cost of materials and provisions for change;

- the suitability of the designed container system for the selected method of handling and transferral;
- the possibility of a dual purpose container system suitable for transport and emplacement;
- the inspection procedures and quality control for all stages from fabrication to operation.

The EIS should discuss the circumstances and mechanisms leading to all possible causes of container failure, or release of radionuclides and other contaminants during loading and unloading. Measures to prevent the possibility of breaching, and to minimize its effects should be described. The EIS should describe the predicted performance of the container system, taking into account the probable modes of failure. This should include the following:

- a definition of "container failure";
- a description of possible models for container failure; and
- a discussion of the mechanisms of weakening of the material of the container system.

The EIS should describe methods to be used for monitoring the integrity and performance of the container system during transportation. This should include:

- a description of monitoring methods to assess performance and to anticipate early failure;
- a statement of the criteria for tolerable deviations from predicted behaviour.

#### **7.43 Operation of Transportation System**

The EIS should explain the operation of the transportation system. This should include the following:

- proposed modes of transport;
- proposed transport routes, and criteria for acceptance and rejection of transport routes;
- public involvement with decisions concerning the choices of transport modes and routes;



- proposed procedures for the transfer of nuclear fuel waste from storage pools to a vault;
- risks related to all aspects of transport;
- safety record of current mode of transport of nuclear fuel waste;
- the volume, frequency and timing of shipments;
- measures to address public concern regarding the transport of nuclear fuel waste and methods of keeping the public informed of transport methods, routes, etc.;
- safety measures and their enforcement (e.g. hours of work, speed of transport, drug abuse, training, escorts, maintenance of vehicles, scheduling of shipping, inspection of containment unit and vehicle);
- monitoring of the location of the transport unit;
- measures to respond to transport delays (vehicle operation problems, traffic congestion, blockades, sabotage, criteria for returning the nuclear fuel waste to storage pools);
- demonstration that considerations of climate, terrain, road and other physical conditions affecting transportation in a typical Canadian setting have been thoroughly examined;
- remedial measures, if necessary.

#### 7.44 Labour Requirements

The EIS should explain the labour requirements for the construction and operation of the transportation system. This should include the following:

- the use of local or outside workers ;
- initial and ongoing training of transport workers;
- measures to ensure safety of workers during handling of used nuclear fuel.

#### **7.45 Emergency Planning**

The EIS should outline its emergency planning and response system. This discussion should include the following:

- an emergency response plan, including responsibilities of parties involved, availability of equipment, and public warning systems;
- accident scenarios;
- financial responsibility for emergency response;
- initial and ongoing training of emergency response team.

#### **7.5 Cost Analysis**

The EIS should provide estimates of the total cost of the concept, as well estimates for its major components, indicating sources of funding. The total anticipated short-term and long-term cost should be compared to the cost of alternative nuclear fuel waste management options, to the extent possible. The cost of monitoring, possible mitigation and compensation should be included.

The EIS should also contain a risk-benefit analysis of key components of the concept indicating their costs versus reductions in risk to the environment.

The budgeting and cost control system, and approval processes for additional funding should they be required, should be identified.

#### **8. Environmental Impacts**

The EIS should include a discussion of all anticipated potentially significant impacts of the disposal facility and its contents on humans and the natural environment in the short-term and the long-term. The short-term is understood to be the time period of planned human activities at a site. It includes the period of the site characterization, construction, the loading and closure phases, and a post-closure monitoring phase. The long-term is understood to be the time period after closure and abandonment of the facility.

The description and discussion of possible impacts should be organized according to key time intervals, identifiable stages

(e.g. initial conditions, construction, loading, post-closure, etc.), and important locations in the vault, rock mass and surface environments under appropriately-selected scenarios. These selected scenarios should represent several types of environmental and socio-economic conditions (e.g. no growth in nuclear power production, major growth in nuclear power production, local and global climate change). This description and discussion should include wherever possible the use of time charts. The EIS should discuss the risk, magnitude, timing, geographic extent and significance of possible impacts, the assumptions upon which predictions of impacts are based, and the uncertainties. In this discussion, consideration should be given to specific issues raised in Section 6.0, where appropriate.

Impacts during the operation of the disposal facility as a result of possible unexpected problems such as malfunction and anomalous environmental events, as well as under normal conditions should be described. The probability of unexpected problems and environmental surprises should be assessed.

The EIS should investigate the possibility of the accumulation of impacts from concept implementation and other human activities, and discuss the possible effects on humans and the natural environment. This discussion should include, but not be limited to, the following: temporal and spatial extent of these impacts, key elements within human communities and the natural environment that could be affected, bioaccumulation of radionuclides and other contaminants, effects of continuous low-level radiation exposure, and a suggested design of a monitoring scheme that includes the provision for following the accumulation of impacts.

Previous projects with similar short-term effects on humans and the natural environment might provide relevant examples to enhance the reader's understanding of these impacts.

The extent and significance of knowledge gaps should be identified, particularly where such deficiencies affect predictions of impact (e.g. radiation effects on non-human biota, active interfaces between the container and microbiota). Needs for further research or data collection to improve the understanding of the system and confidence in predictions should be identified.

The EIS should discuss the potential health impacts of radiation, radionuclides and other contaminants on humans and various components of the natural environment in the short-term and the long-term. Consideration should be given to specific issues raised in Sections 2.1 and 3.3, where appropriate. The discussion should not be restricted to mortality and should include, but not be limited to, the following:

- natural background radiation;



- non-radiological and radiological health impacts associated with the construction, operation, and closure of the disposal facility, and with the transportation and handling of nuclear fuel waste;
- potential health impacts from radiation, radionuclides and other contaminants to humans and other biota in the surrounding areas;
- ability to measure and monitor physical and psychological health;
- psychological stress resulting from public concerns regarding health impacts ensuing from a nuclear fuel waste disposal facility.

The EIS should also review what is known about the effects of radioactivity on non-human biota, including sublethal but possibly mutagenic effects of chronic low-level exposure to high-LET (Linear Energy Transfer) radiation. Knowledge about these effects should then be used to evaluate potential short-and long-term impacts on biotic populations and communities, and on ecosystems.

In addition to the identification of significant impacts, an investigation and discussion of options and measures to avoid, minimize, mitigate or compensate for these impacts, and the effectiveness of adopted measures should be included. Residual impacts remaining after all mitigating measures have been considered should be identified.

The EIS should discuss and justify the plans for the monitoring of impacts including, but not be limited to, the following:

- the monitoring methods used, and the storage of records;
- the temporal and spatial extent of the monitoring studies;
- the subjects and parameters monitored, and the criteria used in their selection;
- public consultation and involvement, and the communication of the monitoring results.

The EIS should also address various possible scenarios with respect to the amount of nuclear fuel waste that must be accommodated, including:

- no growth in nuclear power production;
- the shutdown of existing nuclear power facilities;
- major growth in nuclear power production, for example to

replace fossil fuel power production.

### 8.1 Baseline Conditions

In order to establish a reference baseline against which the impacts of the disposal facility and its contents can be measured, local human communities and the natural environment, particularly regional ecosystems, should be described in terms of those parameters that are relevant to the assessments of the environmental impacts in the short-term and the long-term. The EIS should therefore describe and distinguish the various sets of baseline conditions that are required for these assessments, and the methods and criteria used in the selection of these baseline conditions. Where possible, the ranges of the relevant natural and human parameters in typical candidate site environments should be specified.

In the selection of baseline conditions, consideration should be given to, but not be limited to, the following:

- temporal and spatial extent;
- present human populations and relevant demographics;
- physical and psychological health of the populations;
- local economies and infrastructure including housing, transportation networks, health services, recreational facilities, utilities and energy supply;
- employment situation including types and levels of skills, incomes, employment trends, and training facilities;
- land use including current plans, legislation, trends, valued areas (e.g. heritage, economic, natural, archaeological, and spiritual), aboriginal views on land use, and aboriginal land claims;
- key physical (e.g. climate, weather), biological (e.g. fish, wildlife), chemical (e.g. water quality, soil chemistry), and energy (e.g. main primary producers, important detritivores) components, and important relationships among these components;
- biological energy flows, critical transfer points between trophic levels, and radiation pathway mechanisms;
- biological community indices such as species habitat, diversity, distribution and abundance;

- successional stage(s) and the vulnerability to disruption of succession;
- key indicator and rare or endangered species;
- land surface features, including soils, sediments, topography and functional relationships between the geosphere and the biosphere (e.g. nutrient cycling, hydrological patterns, habitat);
- atmospheric conditions, including prevailing weather patterns;
- surface water hydrology and limnology for still water and flowing water systems, especially key factors that can affect contaminant transport, fate and toxicity (e.g. seasonal flow events, lake temperature, stratification, lake sediment chemistry and lake trophic status);
- chemical and radiochemical composition of the groundwater and surface waters.

The changes in the human communities and the natural environment (independent of the establishment of the disposal facility) that can be expected, and how these changes may affect baseline conditions should be discussed. This discussion should include, but not be limited to, the following:

- human activities;
- natural biological succession;
- climate change;
- post-glacial adjustments;
- possible changes in regional groundwater flow systems that could result from climatic or geologic changes.

## 8.2 Short-term Impacts

Significant impacts on the natural environment (geosphere, biosphere, hydrosphere and atmosphere) and on humans as a result of the transportation and handling of nuclear fuel waste, and the disposal facility construction, vault loading, and the closure should be described, and their local and regional significances identified.

Also, the conditions under which discharges of radionuclides and other contaminants might possibly occur, the probability of such occurrences and the possible consequences on humans and the natural



environment as a result of these occurrences should be considered.

The EIS should discuss the potential health impacts of radiation, radionuclides and other contaminants on humans and various components of the natural environment in the short-term.

The EIS should examine the impacts on demographics of potential host communities and regions including, but not limited to, the influx of non-resident labour, the possible creation of new communities, and a boom and bust scenario.

The EIS should consider the impacts on the employment situation of the potential host communities and regions including, but not limited to, employment opportunities, incomes, non-resident versus resident labour, the availability of skilled labour, and local training facilities.

The EIS should examine the economic impacts on the host community and on the region and to the Canadian public during the various stages of concept implementation. This examination should include, but not be limited to, impacts on surrounding property values, tourism and other industries, and hunting, trapping, fishing or traditional ways of life, including aboriginal traditional ways of life. The EIS should also address the issue of compensation.

The EIS should consider the effects of the disposal facility on land use including predicted changes in land use, and effects on aboriginal land claims.

The EIS should discuss the impacts of the disposal facility on the infrastructure of the surrounding area. This discussion should include, but not be limited to, housing, transportation networks, education facilities, health services, recreational facilities, utilities, and energy supply. The EIS should identify any requirement for infrastructure improvement, and the financing of such improvements, required to support the disposal facility.

The EIS should examine the impacts on the lifestyle of the surrounding populations including, but not be limited to, the effects on the values and lifestyle of host communities and regions, and on aboriginal values and lifestyle.

Consideration should also be given to, but not limited to, the following:

- effects of vault construction and operation on groundwater characteristics;
- effects on surface hydrology from transportation, construction and operation;
- possible chronic contamination effects on the food chain and

dependent higher animals resulting from discharges (radiological and non-radiological) to the environment;

- changes in species diversity, distribution or abundance;
- possible loss of biota (e.g. due to localized species extinction, reduced reproduction rates, a more unfavourable environment) within the habitat resulting from all aspects of construction and operation activities;
- potential for longer-term effects on structure or function of ecosystems through disruption of nutrient cycling, habitat loss, species diversity changes, physical and chemical changes that alter the fate or toxicity of contaminants, etc.);
- potential effects on soil and sediment chemistry, water and air quality.

### 8.3 Possible Long-term Impacts

The long-term is understood to be the time period after closure and abandonment of the facility. Long-term impact therefore relates primarily to unforeseen events, worse-than-expected conditions, or gradual changes in the natural environment that might cause discharges of radionuclides and other contaminants from confinement at unexpected rates. Conditions under which such discharges to the natural environment might occur, the risks of such occurrences, and the possible impacts including the accumulation of impacts from other sources on humans and the natural environment should be discussed.

The discussion should include, but not be limited to, the following:

- long-term changes in the rock mass and the groundwater flow system due to the presence of the vault;
- possible long-term impacts of the vault and its contents on the surface environment under stable conditions;
- possible long-term impacts of the vault and its contents on the surface and rock mass environments under conditions of geologic change and atmospheric change;
- theories, models and other tools (including natural analogues) used to identify and assess long-term changes in the rock mass and surface environments;
- the physical, chemical, and biological parameters that could be used to express significant long-term environmental

impacts;

- the scenarios used and assumptions made to predict possible long-term changes;
- the risk of a possible long-term impact occurring, and the basis for selection of risk figures;
- the reliability of predictions of possible long-term environmental impact;
- the criteria adopted to determine when an environmental impact is significant, as well as those used to determine when the risk of a significant impact is sufficiently high to cause rejection of a site.

All discussions of potential long-term environmental impacts should include the corresponding risk figures to natural ecosystems and humans. Potential impacts should be expressed in terms that are readily understandable, such as:

- possible concentrations of radionuclides or other harmful substances at critical reference locations in the rock mass and surface environments;
- the potential radiological dose received by humans and other biota in the vicinity of a site, at critical points in time;
- possible long-term or chronic pollution effects and bioaccumulation in the food chain;
- the potential for additional cancers.

Possible measures that can be taken in the shorter term that would tend to minimize, mitigate or compensate for potentially harmful long-term effects should be discussed.

Long-term changes in the relevant physical, chemical and biological parameters should be shown graphically.









The Royal Society of Canada  
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September 19, 1991

Mr John McEwen  
Federal Environmental  
Assessment Review Office  
13th Floor, Fontaine Building  
200 Sacre-Coeur Blvd.  
Hull, Québec  
K1A 0H3

Dear Mr McEwen:

Re: Draft EIS Guidelines for Nuclear Fuel Waste Management Concept

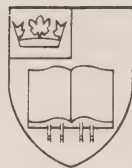
I attach some comments from the Joint RSC/CAE Committee which considered the draft Guidelines drawn up by the Environmental Assessment Panel. Other members of the Committee may yet respond in which case I will forward any further comments to you immediately.

Yours sincerely,

Michael R. Dence  
Executive Director

c.c. Dr R. Haynes  
Dr D. Shaw  
M. L. Nadeau





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September 19, 1991

Comments from the RSC/CAE Joint Committee:

Guidelines for the Preparation of an Environmental Impact Statement on The Nuclear Fuel Waste Management and Disposal Concept Being Reviewed by FEARO's Environmental Assessment Panel.

As a whole the draft document under consideration is a thorough and comprehensive set of guidelines for the EIS to come. Several points, however, require reconsideration or elaboration.

1. RE: 3.3. The idea of 'disposal' seems to have been replaced by 'irretrievable burial' without addressing the fundamental problem. To claim that the Concept under consideration will result in irretrievable burial is clearly misleading. While the nuclear waste remains relatively concentrated and not extremely deeply buried it surely remains technically retrievable. It would not be much more difficult to reopen and mine the waste from the vaults than to mine some of the more highly concentrated ores that occur naturally. At present it would be a matter of money, not technology, and it is not difficult to imagine that in a few hundred years, possibly less, the waste may be once more economically interesting. At that time the technology of the day may make its retrieval quite practical.

This section should ask explicitly for a discussion of long term management and monitoring and when and under what circumstances the facility may be left unattended, presumably to revert to nature.

2. RE: 3.5 especially 3.52. There is no explicit request for knowledge of the geological history of the rock mass, particularly what might be gleaned from its Quaternary history about responses to past changes in regional stress, climate, glacial loading and unloading, etc.

3. RE: 3.5 and 3.6. The possible changes to rock mass and site characteristics due to invasive site characterization and verification techniques should be considered. There is a need to discuss the extent to which drilling and other active exploratory and testing methods would disturb the integrity of the mass and how such methods may be limited or their effects redressed.

4. RE: 4.2 and 5.2. The means by which public involvement and the communication of results will be carried out should be discussed. Information exchange, to be meaningful, needs careful avoidance of technical terminology and an atmosphere of mutual respect. Steps that will be taken to build community confidence and respect should be included.

5. RE: 4.28 and 5.28. Noise is not the only assault on the senses that may result from site characterization and facility construction and use. Methods of minimizing or ameliorating all disturbances should be discussed.

Comments on the document " Guidelines for---Impact Statement

by

Denis M. Shaw  
McMaster University

The document is well prepared and exhaustive in its range. My purpose in writing this brief comment is to express once again a profound disagreement with the the philosophy of the AECL Concept.

That Concept is far too narrowly committed to the principle of nuclear waste storage facilities which will be built, filled, sealed, forgotten. Some textual references follow:

- p.2 para 5: "after the closure of the facility"
- p.6 1.17: "post-closure failure"
- 1.31: "a Concept based on irretrievable burial"
- p.7 1.11: "irretrievable burial instead of retrievable"
- p.8-1.6: "alternative media for irretrievable burial"

There are two reasons for opposing this Concept. The first is the possibility of unwittingly making design flaws which can not later be amended: the important flaws are those with environmental consequences.

The second is wastage of valuable and potentially valuable resources. With the CANDU reactor, approximately 97 per cent of the uranium fuel (dug out of the ground) is unused and would be re-buried. It is further assumed that there will never be any industrial uses for the fission products, although there are many examples of "useless" substances later found necessary to some technology (the elements germanium and gallium are good examples).

It should be added that, if at some future date the contents of a storage facility had in fact to be exhumed, this would be a very difficult and hazardous operation for a "permanently" sealed vault.

I believe that the Guidelines, and in fact the whole review process, should consider retrievable storage as a more desirable goal.









RESPONSE TO DRAFT EIS GUIDELINES

The Golden/Red Lake Environment Group

September 16, 1991

Mr. Chairman, Members of the Panel;

The Draft Guidelines for the preparation of an Environmental Impact Statement is a thorough, well written document which goes a long way towards addressing the concerns expressed during the scoping hearings last year.

While acknowledging the good work that the Panel has done to date we feel obliged to comment in a general sense on the process of this Review. We have also included specific comments for consideration in the preparation of the final draft of the Guidelines.

GENERAL COMMENTS:

Many of the points raised require answers which do not exist in our collective experience. Not even A.E.C.L. can provide these answers. This invites "approximations" or "best guesses" which if well prepared could be construed as "truth".

In the area of Criteria and Assumptions it appears that we are asking the Proponent to make the rules on one hand and then demonstrate how they intend to follow them on the other. We would feel much more secure knowing that there were existing regulations and asking the Proponent how well those regulations would be met.

The whole question of "generic" site selection is meaningless without something to relate to. Describing an idyllic natural and human environment in which to site a nuclear dumpsite is really begging the question.

We feel very strongly that this is a national issue which affects all Canadians regardless of whether or not they reside in a province which produces nuclear waste. If we assume the Concept is accepted for domestic waste the tendency would surely be to have it extended to include waste from other countries as well. Any assessment of the question at the point it becomes "national" would not be as comprehensive as this present process. We therefore strongly urge you to extend the process to include all provinces and Territories at every step.



SPECIFIC COMMENTS:

3.33 Criteria and Assumptions

This section does not give a clear sense of what the rules of the game will be. It leaves the Proponent too much flexibility in reporting only that which would be most beneficial to its case.

3.512 The Container System

Include the following:

- "describe what steps could be taken to mitigate negative effects if monitoring indicates early failure"

3.513 The Vault System

Include the following:

- "describe the manner in which a buffer area of no disturbance by future mining operations would be assured"

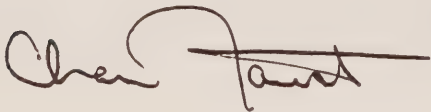
4.25 Land Use

Include the following:

- "the impact on future potential for resource development and exploitation (eg. mining)"
- "the impact on present and potential tourism development"

6. Alternatives to Irretrievable Burial

This section does not promote an objective evaluation of alternative management methods.

A handwritten signature in dark ink, appearing to read 'Charles Faust', with a long horizontal stroke extending to the right.

Charles Faust  
Chairman







University of Waterloo

*Faculty of Environmental Studies*

Department of Environment and Resource Studies

Waterloo, Ontario, Canada N2L 3G1

(519) 885-1211 x 3407 Fax (519) 746-0292

12 September 1991

Susan Toller

FEARO

13th Floor, Fontaine Bldg.

200 Sacre-Coeur Blvd.

Hull, Québec

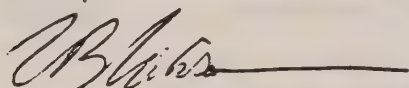
K1A 0H3

Dear Ms Toller,

Enclosed please find a comment with two recommendations for revision of the draft *Guidelines for the Preparation of an Environmental Impact Statement* released by the Panel reviewing nuclear fuel waste management.

I would appreciate receiving a copy of the final guidelines and the Panel's rationales for accepting or rejecting proposed revisions.

Sincerely,



Robert B. Gibson, PhD.

Associate professor

*A Comment on the Draft Guidelines for the Preparation of an  
Environmental Impact Statement issued by the Environmental  
Assessment Panel Reviewing the Nuclear Fuel Waste Management and  
Disposal Concept*

*Robert B. Gibson, Department of Environment and Resource Studies, University of  
Waterloo, Waterloo, Ontario, Canada N2L 3G1*

*September 1991*

The main deficiencies of the guidelines result from the limitations of the panel's terms of reference. In particular, the guidelines fail to address waste reduction, especially with regard to desirability of generating further high-level nuclear wastes in the future. Consideration of waste reduction possibilities and implications is now conventional practice in waste management planning and assessment, and the exclusion of these matters from the present exercise is regrettable.

If there is any possibility that the terms of reference might now be revised to permit inclusion of waste reduction considerations, the Panel should seek a revision. But even if the terms of reference are not revised, the Panel can and should still recognize that there is a difference between the existing wastes awaiting long term disposal, and new wastes not yet generated, and incorporate this recognition in the *Guidelines*.

Perhaps the most crucial point at which the existing vs possible future wastes distinction should be noted, and its implications addressed, is section 3.33 - *Criteria and Assumptions*. The main issue in this section is what criteria are used to judge the acceptability of the proposed concept. It is evident, and should be made explicit in the guidelines, that the criteria appropriate for evaluating a concept for disposal of

existing wastes differ from the criteria that should be use in evaluation a concept for disposal of possible future wastes.

For the existing wastes, the goals is to find the "least bad" option for long term management. It may well be that all available options have negative aspects that cannot be fully mitigated. But the choice is between acceptance of the "least bad" long term option and continued reliance on the temporary storage facilities now used. The relevant approval criteria, then, centre on comparing the alternative disposal options and selecting the one that is least damaging or threatening.

For disposal of new wastes, the situation is very different. These wastes have not yet been generated, and need not necessarily be generated. Consequently an additional option (reduction or elimination of the wastes) is available and a tougher test of acceptability is needed. Ordinarily in such cases, acceptability would be judged in part through comparison of the various waste disposal and waste reduction/elimination options. Unfortunately, examination of waste reduction/elimination has been precluded from the present deliberations. This matter may be considered elsewhere at some point, but for now at least the assessment and the panel review will have to proceed without any basis for informed judgement about whether it would be more beneficial to stop producing the wastes or to continue producing the wastes and adopt a certain disposal concept. Consequently, any disposal concept for new wastes must be examined on its own merits, and any acceptable proposal must be shown to be a positive and desirable undertaking aside from the waste disposal benefits it may offer.

Application of these different criteria is complicated in the nuclear fuel waste case because the proposed concept is intended to deal with both existing and future wastes. But it is clearly unacceptable use the lower "least bad" option criteria to approve a scheme for disposing of future wastes (thereby reducing a barrier to further waste production). And it may well be impossible for the proponent to justify approval of the proposed concept if it is judged against the higher standards of positive desirability aside from waste disposal benefits. The practical result may be that the proposed concept is found acceptable for the disposal of existing wastes, but not for disposal of future wastes.



Certainly this is a matter the panel will have to address, explicitly or implicitly, in its own judgements on what criteria to apply. It would be appropriate, however, to draw the proponent's attention to the issue from the outset, and to have the issue of differing criteria addressed clearly in the Environmental Impact Statement.

**Recommendation:** A clause should be added to section 3.33 Criteria and Assumptions to require the proponent to outline *"the criteria used to evaluate the concept's acceptability (a) for disposal of existing wastes, and (b) for wastes that may be generated in the future"*.

Proper judgement on whether the proposed concept should be approved at this time - even just as a "least bad" response to the existing wastes problem - entails comparison of available options. Two basic comparisons are needed. These involve (i) assessment of the relative merits of all reasonably feasible long term management options to determine whether the proposed concept is the "least bad" management option currently available, and (ii) comparison of the current "least bad" option with the alternative of continuing to rely on temporary storage for a specified period while further research into long term management options is pursued. The latter comparison entails evaluation not just of the current acceptability of temporary storage, but also of how hazards and other concerns about temporary storage may increase over time.

The draft *Guidelines* include requirements for some of the information needed for these comparisons, especially the first one. Section 3.3 appears to require justification for the selection of the proposed concept, presumably in light of an assessment of alternative approaches; "evaluation of alternative methods of irretrievable burial" is explicitly required in section 3.4 and section 6 requires examination of "alternatives to irretrievable burial." There is, however no explicit requirement for the proponent to establish, on the basis of a comparative evaluation of

the alternatives, that the proposed concept represents the "least bad" currently available long term management option.

The draft *Guidelines* are less successful in demanding the information needed for choosing between immediate approval of the proposed concept and extended reliance on temporary storage to allow for further research into long term management options. Section 2.2, paragraph one, and the first sentence of section 2.3, require information for assessing the acceptability of current practices. But there is no mention of how this acceptability may change over time, and no requirement to consider the option of delay in approval to allow further research.

**Recommendation:** A new section should be added at the end of the *Guidelines* requiring the proponent to present its case for immediate approval of the proposed concept. Subsections here should require the proponent (i) to present a comparative evaluation of the alternatives and establish that the proposed concept represents the "least bad" currently available long term management option, and (ii) to present a comparison of the current "least bad" option with the alternatives of continued reliance on temporary storage for ten, thirty and fifty years, and establish that immediate approval of the proposed concept is preferable to a delay of ten, thirty or fifty years to permit further research into long term management options. In support of the latter portion of this requirement, section 2.2 should be expanded to include discussion not just of the present adequacy of the temporary management regime, but also of how the present situation may change over the next three decades.









# People Against Lepreau 2 Campaign

P.O. Box 4012, Station B., Saint John, NB  
Canada E2M 5E6

## RESPONSE TO DRAFT GUIDELINES

### FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT

TO

THE ENVIRONMENTAL ASSESSMENT PANEL  
REVIEWING THE NUCLEAR FUEL WASTE MANAGEMENT CONCEPT

Respectfully Submitted by;

Julie Galbraith  
David Thompson  
Mary Ann Coleman  
Janet Dingwell





Terms Of Reference

Foremost among our concerns, (and the concern most frequently voiced by New Brunswickers who attended our series of public meetings held around the Province), are the Terms of Reference for this review. Page 4, paragraph 3 of the Terms of Reference says;

The energy policies of Canada and the provinces; the role of nuclear energy within these policies, including the construction, operation and safety of new, or existing nuclear power plants; fuel reprocessing as an energy policy; and military applications of nuclear technology are issues that are outside the panel's mandate and should not be addressed during the review.

These very issues which are excluded from the review are at the top of the list of issues and concerns which the public of New Brunswick wish to address.

We therefore request that the panel go back again, to the minister's and insist that the terms of reference be changed to allow for a full public review of the issues excluded on page 4, paragraph 3.

We are fully aware of indications that there may be another environmental impact assessment and review on energy policy which may address these issues at some time in the future. However, many ministers in various governments over the years have promised that there would be a public review of the nuclear industry, but none of these promised public reviews were ever carried out.

Until such time as an Environmental Impact Assessment and Review on Policy is arranged we cannot be sure that it will ever occur.

It is interesting to note that both opponents and proponents of nuclear energy who attended our public meetings agreed that the Terms of Reference for the review should be broadened to examine energy policy and the environmental effects of the production of energy from all sources, so that we can effectively plan to minimize the environmental impact on the planet.

We therefore request that the panel go back again, to the minister's and insist that the terms of reference be changed to allow for a full public review of the issues excluded on page 4, paragraph 3.

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It is interesting to note that both opponents and proponents of nuclear energy who attended our public meetings agreed that the Terms of Reference for the review should be broadened to examine energy policy and the environmental effects of the production of energy from all sources, so that we can effectively plan to minimize the environmental impact on the planet.



CHANGES MUST BE MADE!

The public is extremely cynical of this Environmental Impact Assessment and Review.

The Panel must convey this to the ministers and if the Terms of Reference for the Review are not changed the Panel should resign.

MORITORIUM ON NEW REACTORS  
AND  
WASTE STORAGE FACILITIES

If this review is to have any public credibility it is imperative that a moritorium be placed on the construction and licensing of any new reactors which will lead to the production of more waste, or any new storage facilities for spent fuel, this review is completed.

We therefore ask that the panel make this request to the Ministers.

WHAT IF ?

- What if the proposed Geological Storage Concept is proven not to be acceptable?
- Will nuclear reactors and the production of waste be phased out?

An answer must be provided now before this review proceeds.



'STORAGE' NOT 'DISPOSAL' CONCEPT

The people of New Brunswick are adamant the AECL's concept be labelled a storage concept, rather than a disposal concept. The rationale behind this, is that the word 'disposal' might lead people to believe that the nuclear waste has been permanently disposed of, thus not requiring further care. Since high level nuclear waste will need to be monitored for several thousand years, it is in fact, being stored, not disposed of. In order to foster a commitment from future generations with regard to carefully managing high level nuclear waste, it is essential not to mislead future care-takers into believing that the waste problem has been permanently taken care of and solved. Thus 'storage concept' is a more accurate term for AECL's proposal.

RELEASE INFORMATION ON POTENTIAL WASTE STORAGE SITES

Atomic Energy Canada Ltd., (AECL), must release to the public without delay, the complete list of potential nuclear waste storage sites which they have identified. AECL must also release to the public complete information on all site studies and investigations which have been carried out to date, are underway, or are planned.

### FUNDING FOR PUBLIC PARTICIPATION

New Brunswickers request that the blatant financial inequality between AECL and Public Interest Groups be addressed during this review. This is particularly relevant during this stage of the process because active participation, quality of resentations, and the preparation of documents, is in large part economic. The public has never been provided with the financial means to consult with specialists who may have grave misgivings about the nuclear waste disposal concept as outlined by AECL. The public must be afforded access to quality information on all aspects of a nuclear waste disposal concept. Views that are provided only by the proponents of such a concept are not enough on which to base competent decisions.

New Brunswickers also request that AECL determine and identify clearly all further money to be spent on the promotion of the nuclear waste disposal concept and nuclear power in general by AECL. Equal funding must then be provided for public interest groups to present varying views. Only then, will a balanced picture be available to those who need it most; the general public. To date, the general public has never been given a balance of views, rather information has been weighted toward the views of the nuclear industry. A balance is essential if decisions are to be made that will directly affect many future generations. If sufficient intervenor funding is not made available for full public participation, this review process lacks credibility. Glossy T.V. ads are always misleading if the opposing views or products are denied on appearance.

REVIEW REQUIRED FOR LEPREAU NUCLEAR WASTE STORAGE FACILITY

An Environmental Impact Assessment and Review of the Lepreau Dry Cannister Storage Facility has not been carried out.

Therefore, we request that the panel include a full Environmental Impact Assessment and Review of the Dry Cannister Storage Proposal at Lepreau within this review.

Furthermore, we ask that the panel request that no permission be given for the transfer of any additional spent fuel from the spent fuel bay to the dry cannister storage facility until the Environmental Impact Assessment and Review has been completed.

The Dry Cannister Storage Review would examine the following concerns;

- It would examine in detail the relative safety of the existing spent fuel bay, (pool), storage system and the proposed Dry Cannister Storage System.
- It would examine potential radiation emissions from the current spent fuel bay storage system and the proposed dry cannister storage system, as well as the proposed combination of both systems; in relation to releases to the biosphere and subsequent plant, animal and human exposure.
- It would make available and readily accessible for public review all technical information on the cannisters as well as the transportation and removal of equipment.
- It would examine in detail all potential accidents which could occur during the removal and transport of spent fuel from the spent fuel bay to the dry cannister storage facility, and the potential environmental and health impacts of such accidents.
- It would make available and readily accessible for public review all safety studies, reports and data from any tests which have been carried out on equipment and containers which would be used to remove, transport and place spent fuel from the spent fuel bay storage to the cannister storage.
- It would make available and readily accessible for public review, emergency contingency plans and details of emergency equipment.



- It would examine and assess the potential for spent fuel to be removed from the spent fuel bay compared to the proposed dry cannister for purposes of reprocessing, sale or diversion for military or other such purposes, both with and without government permission.
- It would examine, assess and compare in detail the vulnerability of the spent fuel bay, the dry cannister storage facility and the combination of both to terrorist attack.
- It would examine and assess the use of dry storage cannisters for spent fuel at a large operating nuclear plant as opposed to dormant facilities, including security.

INTIMIDATION

At our public consultation meetings these disturbing concern were voiced.

Intimidation keeps people from speaking out on nuclear energy issues.

Many citizens of New Brunswick feel they cannot speak out on nuclear issues because of fear of reprisal in the way of job loss or loss of future employment opportunity for them and their families.

Concern was expressed that we are living in a society here which intimidates individuals from speaking up.

THESE CONCERNS MUST BE ADDRESSED!

What will be done to encourage people to speak out on nuclear issues, and relieve these fears people in New Brunswick have ?

What will be done to ensure and guarantee people who speak out on nuclear issues, and their families, will not suffer reprisals of job loss or employment opportunities?

GEOLOGICAL CONCERNS

A review of geology, potential for movement and earthquake risk in the Point Lepreau area and the region is now required in view of plans to store spent fuel waste in concrete cannisters at Point Lepreau.

The proponent must:

- Identify whether New Brunswick is still on the list of possible locations for a geological storage facility.
- We have received information that granite formations in New Brunswick are fractured and also that rock bursts could occur if these sites were used for the proposed facility.

If New Brunswick is still on the list for the proposed facility these concerns must be addressed.

IMPORTATION OF WASTE

We request that AECL address the following matters.

RE: The possible importation of spent nuclear fuel waste.

- Identify in detail the potential for nuclear spent fuel waste to be imported for storage in New Brunswick.
- Identify in detail the potential for nuclear spent fuel waste to be imported into Canada.
- Identify in detail measures which can be taken to prevent the importation of nuclear spent fuel wastes into New Brunswick.
- Identify in detail measures which can be taken to prevent the importation of nuclear spent fuel wastes into New Brunswick.
- Identify in detail measures which can be taken to prevent the importation of nuclear spent fuel wastes into Canada.
- Make available to the public all information on file. RE: Discussions and meetings AECL have had on the subject of importation of spent nuclear fuel.
- Identify the amount of spent nuclear fuel that has been produced in Canada as the result of electricity exports.



EXPORT OF SPENT FUEL

We request that AECL address the following matters.

RE: The possible export of spent nuclear fuel.

- Identify if the United States or any other country could legally claim ownership of spent nuclear fuel produced by a reactor in Canada, if they participated in ownership of the reactor, purchased its power or provided the fuel.
- Identify under what circumstances if any, spent nuclear fuel could be exported.
- Identify if there presently are any agreements in place for the export of spent nuclear fuel from Canada to any other country.
- Identify what measures can be taken to prevent the export of spent nuclear fuel.
- Make available and readily accessible for public review all information in AECL files. RE: The subject of export of spent nuclear fuel. This would include minutes and notes from meetings and discussions.

TRANSPORTATION OF NUCLEAR WASTE

We request that AECL address the following matters.  
RE: The transportation of spent nuclear fuel waste.

- Provide a detailed comparative analysis of all transportation options in respect to safety, feasibility and cost.
- Describe in detail what weather or highway conditions would prevent or interrupt the transportation of spent fuel waste.
- Describe in detail the security which would be provided for the transportation vehicles.
- Identify and describe in detail, emergency equipment and personnel which would accompany transportation vehicles.
- Identify in detail how the public will be informed of when nuclear waste shipments are to occur.
- Describe how transportation vehicles or convoys will be marked for public recognition.

COSTS

We request that AECL address the following matters.

RE: The cost of nuclear fuel waste management and storage.

- Identify in detail all the projected costs for operating, maintaining and monitoring the facility from the start of the operation until such time in the future when all materials in the spent fuel waste have decayed to natural background radiation levels.
- Identify in detail the cost of environmental monitoring.
- Identify in detail the total costs of any interim storage facilities required such as dry cask storage facilities. the cost of operating, monitoring, replacing and disposing of such facilities.
- Identify in detail the total costs of transporting and handling the spent fuel waste by the various options and methods available.
- Identify in detail the cost of maintaining the necessary emergency contingency plans, for storage, transportation and final storage over the long term.
- Identify the cost for dealing with the worst possible problem which could conceivably occur with the geological storage facility and show the methodology for determining the cost.
- Prepare a detailed critique of the Nuclear Liability Act, examining and addressing in particular its limitations and exemptions from liability.
- Identify the level of financial burden this proposal will place on future generations and how we can determine if future societies will be affluent enough to take care of any problems which could arise.
- Identify in detail who, (what agencies, utilities, governments etc.), will pay the costs for interim storage, transportation, contingency plans, liability, compensation, monitoring and geological storage.

THE GEOLOGICAL STORAGE FACILITY

We request that AECL address the following matters.  
RE: The proposed geological storage facility.

- As a considerable amount of spent nuclear waste has been produced as a result of electricity exports to the United States, will the proposed facility have to meet the same standards as it would if it were located in the United States.
- Are there proposed plans to use this geological storage technology for the storage of toxic waste other than spent nuclear fuel? If so make available for public review all information in AECL files.
- Identify in detail the potential for this technology to be used for the storage of uranium mine tailings.



## SOCIAL AND ETHICAL CONCERNS

The people of New Brunswick request that AECL address the following social and ethical concerns.

- All parts of the proposal must be examined in detail from a sustainable development perspective.
- Define in detail the benefits and risks to the host communities for the various parts of the proposal, interim storage, transportation and long term storage.
- Define in detail the long term benefits and risks to future generations.
- Provide a detailed examination of the proposal from a community control perspective.
- Identify and explain in detail the moral and ethical capacity for humans to consider the impacts of their actions upon distant generations in the future.
- Morally justify how more nuclear waste can be produced without a proven permanent disposal method.
- Examine and outline in comprehensive detail the ability of humans to interfere both intentionally and unintentionally in both the near and distant future with spent nuclear fuel in storage, in such ways as to cause radiation releases to the environment which could effect plants, animals or humans.
- Explain how social stability can be predicted for hundreds of generations into the future.
- Given the public's fervent belief expressed at our meetings, (that it is insane to produce any more nuclear waste), it is incumbent on AECL to demonstrate that the production of nuclear waste is a rational, logical and sane direction in which to proceed.
- Given the public's experience with the nuclear industry, how can we believe what government and the nuclear industry experts say?

Why should we believe them or trust them? New Brunswick's were told repeatedly that there would be no spent fuel waste storage at Lepreau, and now they have built a dry cannister facility to store this nuclear waste for decades to come and have refused to carry out an Environmental Impact Assessment and Review.

RADIATION MONITORING

The people of New Brunswick request that AECL address the following matters and concerns.

- Describe in detail the radiation monitoring program for all interim storage facilities.
- Describe in detail the radiation monitoring program for the transportation of spent nuclear fuel waste.
- Describe in detail all radiation monitoring equipment and methods which will be used.
- As much public concern has been expressed, re; the need for all radiation monitoring to be carried out by organizations which are completely independent of AECL, the Nuclear Industry, the utilities and the Department of Energy, Mines and Resources.

What will be done to ensure that all radiation monitoring is carried out by organizations independent of any nuclear interests and are seen to be completely independent and credible by the public.

- Identify the organizations which are currently monitoring radiation from nuclear reactors and waste storage facilities, and outline their monitoring programs.
- Describe in detail how radiation monitoring data would be made readily available and accessible to the public.
- Describe in detail baseline health studies which will be carried out on human populations around the proposed geological storage site and the various interim nuclear waste storage sites.

- Describe in detail the health monitoring programs, if any, which are presently being carried out at each reactor and waste storage site in Canada, and identify each location where no health monitoring program is being carried out.
- Describe in detail what changes will be made to gear Vital Health Statistics to producing information which would be of benefit in the study of the effects of low levels of radiation on humans.
- Much public concern has been expressed that all health monitoring must be carried out by experts who are completely independent of AECL, the utilities and the nuclear industry.

What will be done to ensure that monitoring is carried out by experts who have no tier or vested nuclear interests?

- Describe in detail how all health monitoring data will be made readily available and accessible to the public.
- Describe in detail what measures will be taken to remove the mental stress of the public and in particular for children.



REGULATORY ISSUES

We request that AECL address the following regulatory matters.

- Identify the organizations who will regulate transportation, handling and storage of spent nuclear fuel waste.
- Outline in detail the roles of the regulatory organizations and their specific responsibilities.
- Outline in detail how the regulatory organizations interact with each other, overlap, mesh and function together.
- Identify in detail the resources of the regulatory organizations.
- Outline in detail how Inspections and Policing will be carried out.
- Outline penalties for violating the regulations.















